CORENET X Structural Submission and IFC-SG Requirements

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Section 1:
Working Together to Prepare Industry Professionals for CORENET X

1. Overview of CORENET X

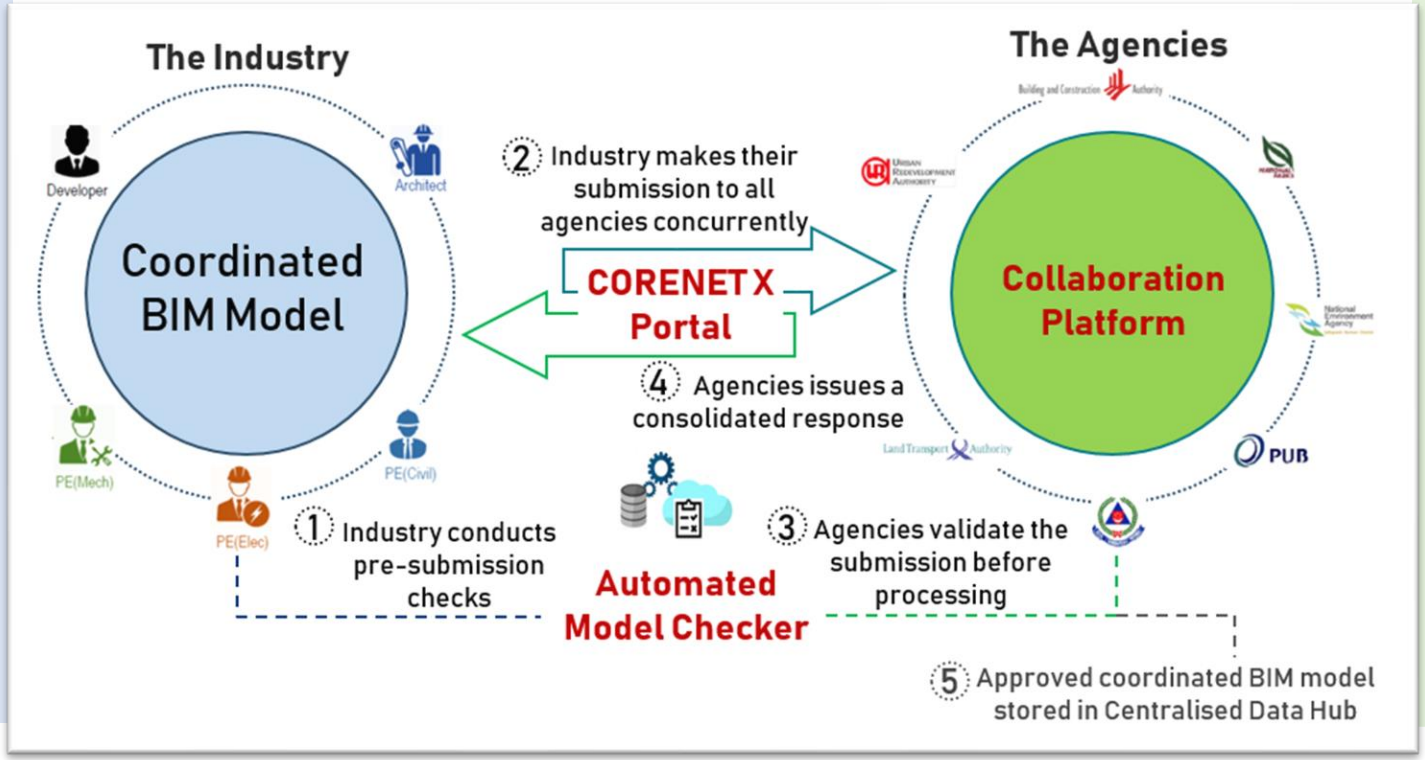
Vision: A Future Ecosystem of Regulatory Approval of Building Works that Accelerates The Transformation of the Construction Industry

FIRST IN THE WORLD

One-Stop Integrated Digital Shopfront

TRANSFORMATION of INDUSTRY

- Promote design coordination and teamwork
- Promote digitalization of construction sector
- Support IDD[1] & DfMA[2] imperatives



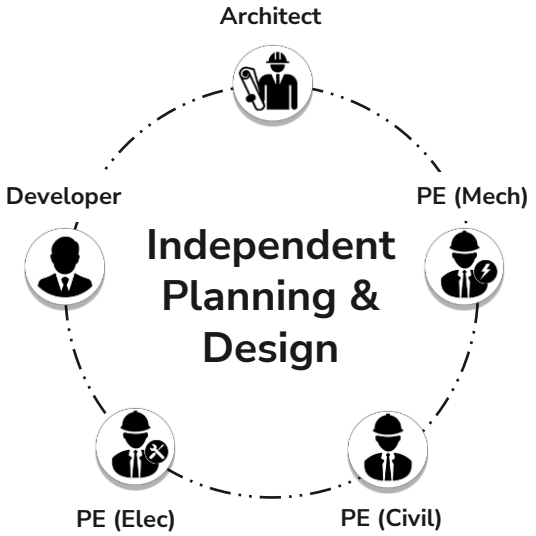
TRANSFORMATION of REGULATORY AGENCIES

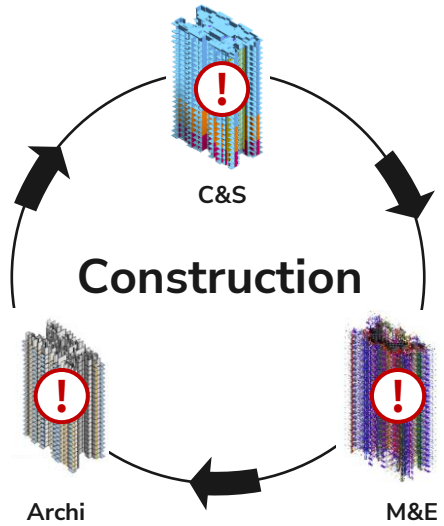
- Reduce silos, iterations & condense touchpoints
- Embrace collaboration & raise productivity amidst rising demands
- Improve accessibility & centralise information towards a Single Source of Truth

[1] IDD is the use of digital technologies to integrate work processes and connect stakeholders working on the same project throughout the construction and building life-cycle
[2] DfMA is a continuum of various technologies and methodologies that promote offsite fabrication from prefabricated components to fully integrated assemblies across the structural, architectural and Mechanical/ Electrical disciplines.

2. Key Changes and Potential Impact – New Regulatory Gateway

Today's Separate and Concurrent Regulatory Approval Process





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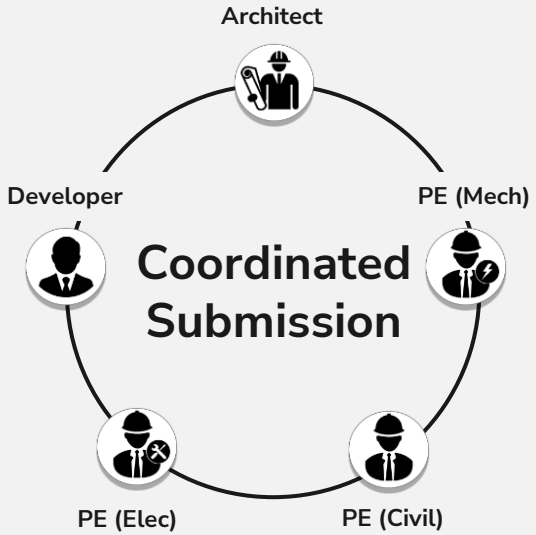
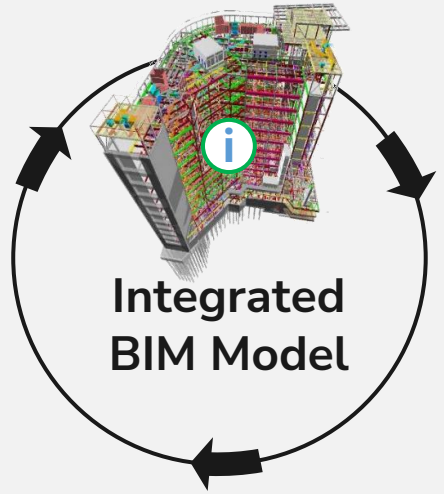
Envisaged Streamlined Regulatory Approval Process



*optional



CORENET X will transform and redesign our regulatory processes into **3 main gateways**

2. Key Changes and Potential Impact – New Regulatory Gateway

Critical Design Parameters

"Showstoppers, non-negotiables"

- **Resolve key parameters** which have an impact on design parameters, before proceeding to detailed design
- **Minimise abortive work** across various disciplines and consultants

Proceed to obtain approval at next Gateway

Foundation Requirements

"Must-haves before Piling"

Detailed Design Requirements

"Must-haves before (Piling) & Launch of Sales"

- **Resolve multi-agency requirements concerning design details** that need to be coordinated before work commences
- **Minimise abortive works** or downstream appeals for unresolved non-compliances

Commence Work/ Launch Sales

2. Key Changes and Potential Impact – New Regulatory Gateway

All other Requirements

Independent (agency specific) technical requirements

- Check for **compliance of specialist details**
- **Expedite clearance of agency-exclusive requirements** from various disciplines and consultants

Start building respective component

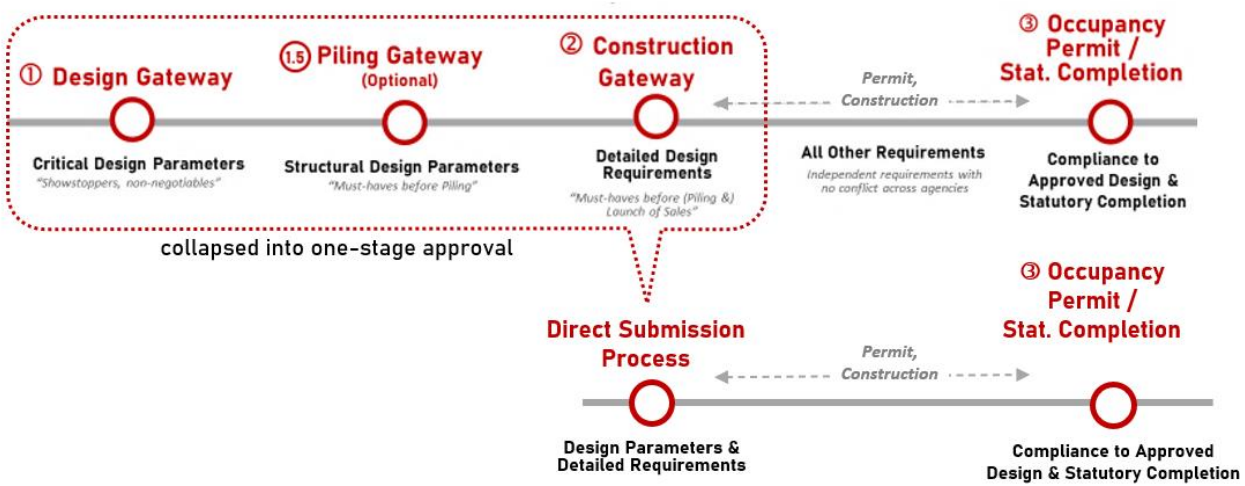
Completion & Compliance to Approved Design

- Site inspection to ensure building works are **constructed as per approved plans and comply with requirements**
- **Ensure completed building is fit for occupation**

Start occupation and obtain statutory completion

2. Key Changes and Potential Impact – New Regulatory Gateway

Direct Submission Process: Differentiated approach for less complex building works that need not be subjected to the typical 3-Gateway process



Examples of eligible type of building works: single-unit residential landed development, standalone pavilion/ linkway/ racking system)

- Developing a single stage approval prior to TOP/CSC, instead of multiple touchpoints at Design Gateway, Piling Gateway (optional) and Construction Gateway.
- Rationalising and consolidating existing Lodgement, Self-declaration and Simplified Submission schemes.

3. Phased Approach to Onboard Industry

Soft launch
Dec 2023

1 Transitional period

- Soft launch in Dec 2023
- Submissions on a voluntary basis
- Allow the industry to familiarise with the new platform and processes

1 Apr 2025

2 Mandatory submission for new projects

1H 2026

3 Onboarding of ongoing projects

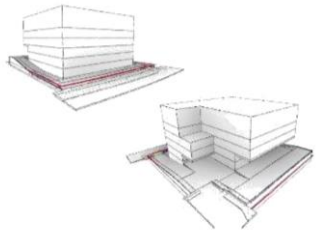
Phased Onboarding	Date
New Projects	
Soft Launch	18 Dec 2023
Voluntary Submission	1 Jun 2024
Mandatory Submission	1 Apr 2025
Ongoing Projects	
Mandatory Submission	1H 2026 *(exact date to be announced later)*

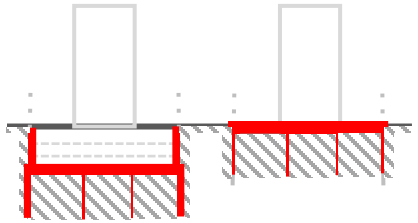
3. Phased Approach to Onboard Industry

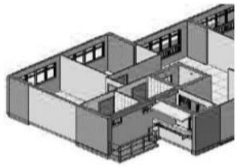
More details on CORENET X can be found at
https://go.gov.sg/cx

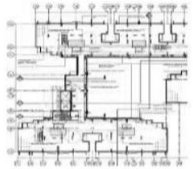
Section 2:
Getting Ready for Structural Submission

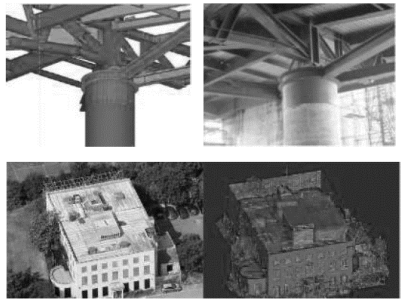
Key Principles of CX Gateway Approval Process











① **Design Gateway**

1.5 **Piling Gateway (optional)**

construction

② **Construction Gateway**

③ **Occupancy Permit / Stat Completion**

Critical Design Parameters
"Showstoppers, non-negotiables"

Structural Design Parameters
"Must-haves before Piling"

Detailed Design Requirements
"Must-haves before (Piling) and Launch of Sales"

Compliance to Approved Design & Statutory Completion

Coordinated submission

Complex structure pre-consultation

Piling → Superstructure

External work

Independent submission*

Demolition

ERSS

Temporary traffic decking

Cladding

Barrier

No dependency on other agencies

(*can be submitted any time after design gateway or DSP and before Completion gateway)

Scope of structural works in Piling Gateway (Optional*)

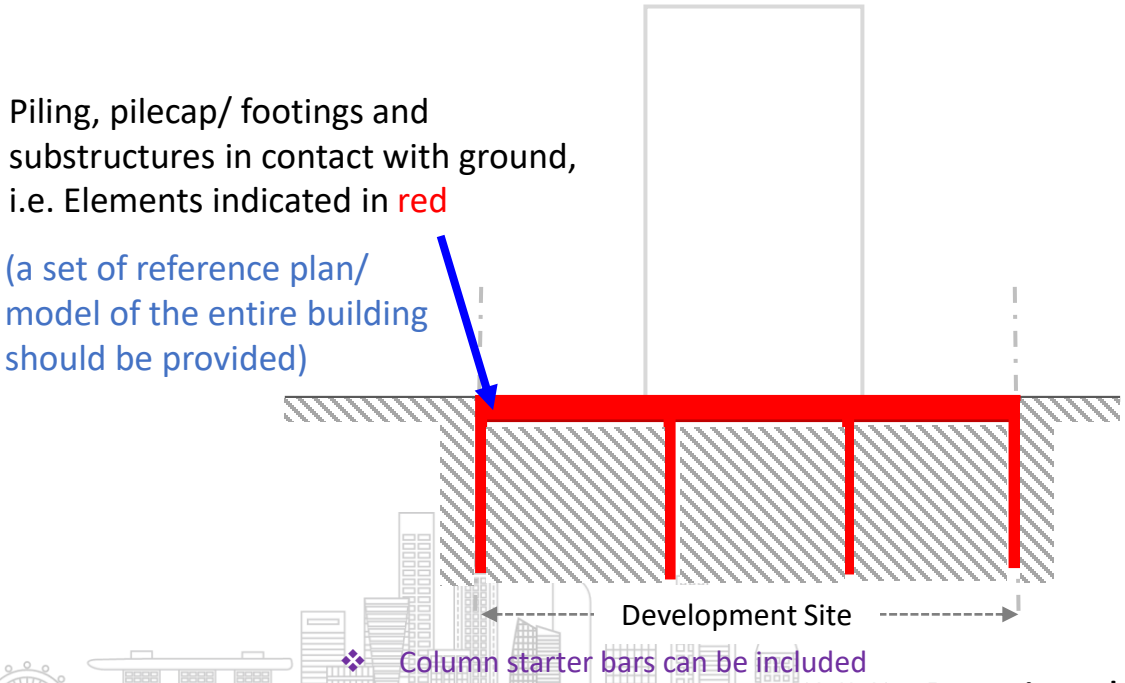
**QPs are to assess the risk involved when opting for piling gateway before superstructure is approved.*

Works affecting Permanent Structures

- LTA's Approval in-principle (AIP) for Pile Design and Pile Layout Plan (only within Railway Protection Zone)
- BCA's Approvals for Piling & relevant Substructure Works

Piling Gateway is deemed to be cleared when all these clearances are obtained as a package

Conventional foundation system

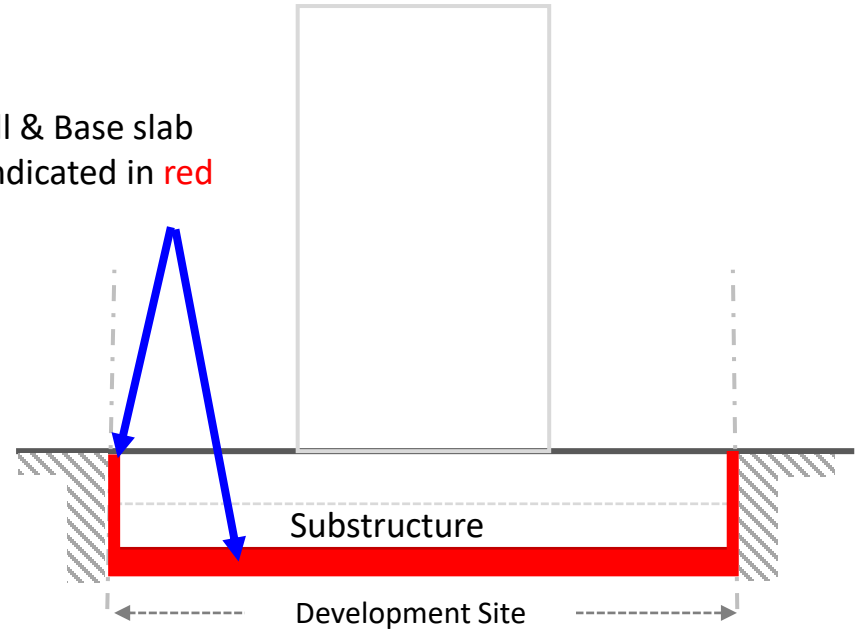


- The Piling Gateway clearance pertains to the design of permanent piling and substructure works (that do not affect internal layout), where its **clearance is for design approval and not for commencement of works**
- Other site works (e.g. for site clearance, temporary protection, etc), which do not form part of the permanent structures but still require agencies' clearances, can be cleared in parallel and need not be tied to the Piling Gateway approval

Scope of structural works in Piling Gateway

Bottom up Construction & Foundation

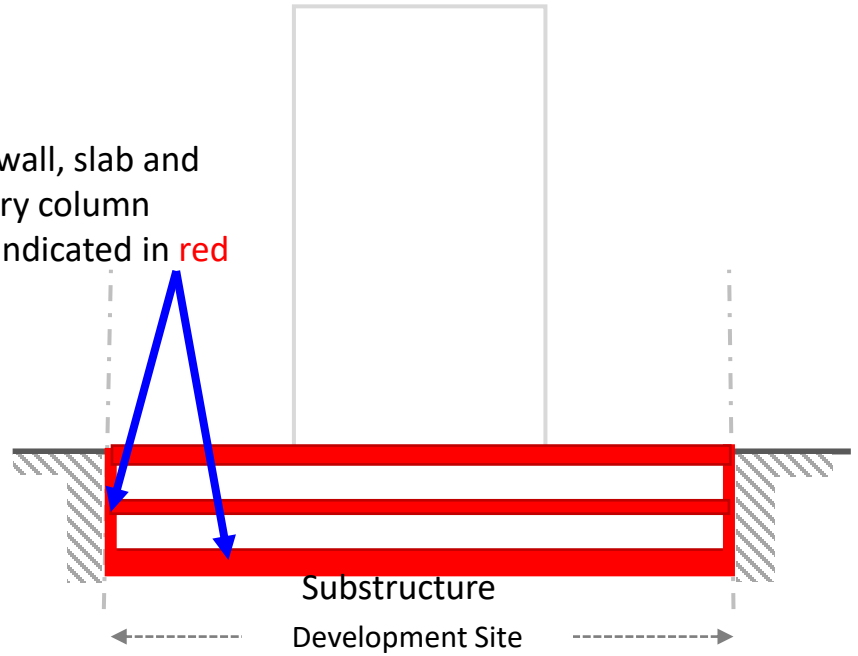
Diaphragm wall & Base slab
i.e. Elements indicated in red



- Column starter bars can be included

Top down Construction & Foundation

Diaphragm wall, slab and
temporary column
i.e. Elements indicated in red



- Any temporary structures to support top down construction must be included.
- For any permanent structures required to be included, QPs must ensure their works will not lead to non-compliances later on (eg: circulation and headroom).

Structural submission package

S/N	Piling Gateway package	Construction Gateway package
1	Piling & Foundation Works IFC-SG model	Complete set of IFC-SG model(s) for all structural elements & details
2	2D drawings limited to the categories below: i. General notes ii. Irregular Pilecap/Footing details	2D drawings limited to the categories below: i. General notes ii. Special details (e.g. slab reinforcement detailing, complex structure detailing, transfer plate detailing, irregular section detailing, precast joints, prestressed details, steel connections.)
3	Design calculation reports from QP, AC, [QP(Geo) & AC (Geo), if needed]	Design calculation reports from QP, AC, [QP(Geo) & AC (Geo), if needed]
4	Additional supporting documents: i. Site investigation report in pdf & AGS format ii. Impact assessment report iii. Topography iv. Relevant annex/forms	Additional supporting documents: i. Site investigation report in pdf & AGS format ii. Impact assessment report iii. Topography iv. Relevant annex/forms
5	Complete set of structural framing plan for reference	Complete set of building plan submitted simultaneously
6	Complete set of building plan for reference	Completion letter of pre-consultation [for complex structure only]
7	Completion letter of pre-consultation [for complex structure only]	

Structural submission package

S/N	Completion Gateway package	Independent submission package
1	Complete set of As-Built IFC-SG model(s) for all structural elements & details	-
2	2D drawings limited to the categories below: i. General notes ii. Special details (e.g. slab reinforcement detailing, complex structure detailing, transfer plate detailing, irregular section detailing, precast joints, prestressed details, steel connections.)	2D drawings with reference back to the coordinated model submitted by the main QP at the Construction Gateway
3	Design calculation reports from QP, AC, [QP(Geo) & AC (Geo), if needed]	Design calculation reports from QP, AC, [QP(Geo) & AC (Geo), if needed]
4	Additional supporting documents: i. Certificate of Supervision of Piling Works ii. Certificate of Supervision of Structural Works iii. Relevant annex/forms	Additional supporting documents: i. Site investigation report in pdf & AGS format ii. Impact assessment report iii. Relevant annex/forms

All these submission package and requirements are stipulated in Code of Practice which published in BCA CORENET X Website.

Expectation of Structural IFC-SG models

- A complete set of IFC-SG structural model shall consist of elements as described in Section 4 of Code of Practice. For example, a structural IFC-SG model should comprise of the following:
  - ❖ Piles
  - ❖ Footings/ pilecaps
  - ❖ Beams
  - ❖ Columns
  - ❖ Walls
  - ❖ Slabs
  - ❖ Staircases
  - ❖ Boreholes

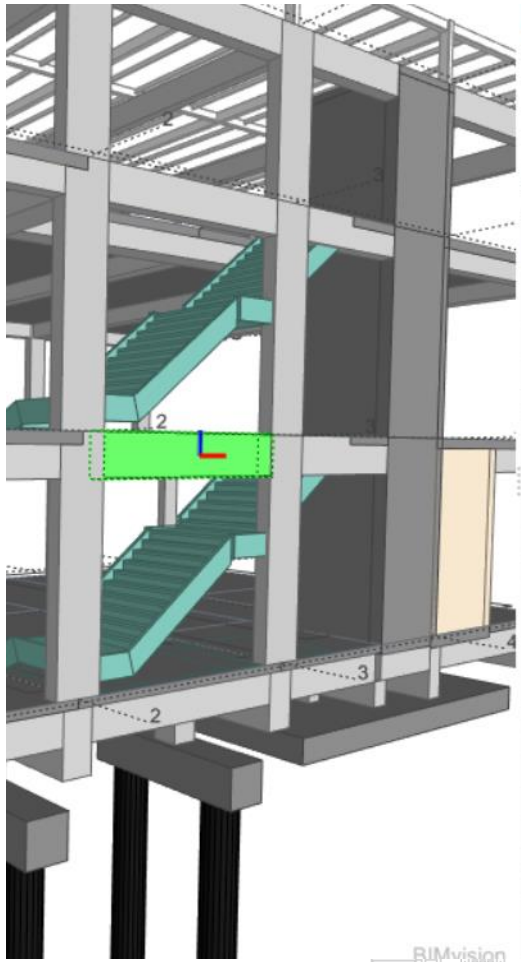
- Details can be represented in 2D to supplement the IFC-SG model, such as :
  - ❖ Irregular pilecaps, raft foundation, slab elements, household shelter/storey shelter elements, transfer plates, precast elements, prestress elements, PPVC modules, steel connections.

All the IFC-SG parameters shall follow the standard naming and units as stipulated in Code of Practice which was published on BCA CORENET X Website.

Link- Code of Practice | Building and Construction Authority (BCA)

Structural IFC-SG models

Examples on IFC-SG parameters

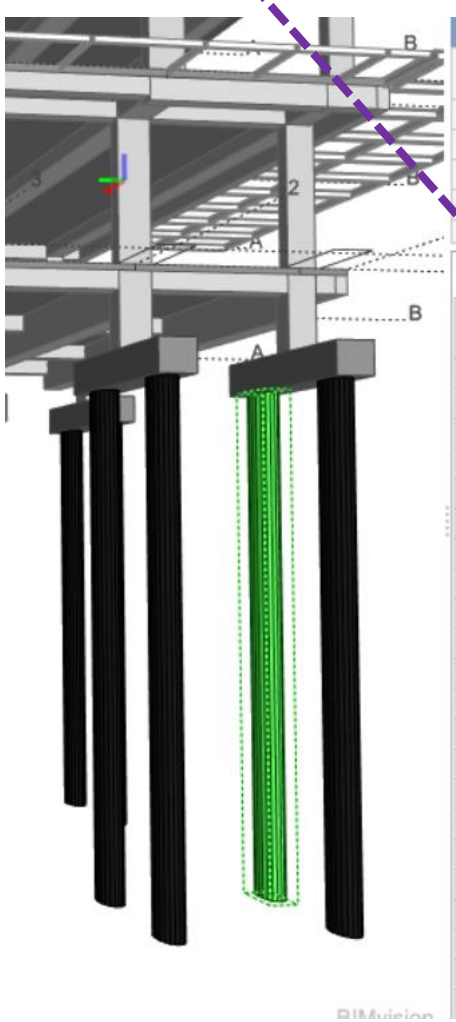


IFC Structure

Active	Type	Name
☑	Beam	Concrete-Rectangular Be...
☑	Beam	Concrete-Rectangular Be...
☑	Beam	Concrete-Rectangular Be...
√ ☑	Beam	Concrete-Rectangular Be...
☑	Beam	Concrete-Rectangular Be...

Properties | Location | Classification | Relations

Name	Value
SGPset_Beam	
BeamSpanType	Interior
ConstructionMethod	CIS
MaterialGrade	C32/40
ReinforcementSteelGrade	500B
SGPset_BeamDimension	
Depth	700
Mark	2B11-3
Width	200
SGPset_BeamReinforcement	
BottomLeft	2H13
BottomMiddle	2H13
BottomRight	2H13
StirrupsLeft	2H10-200
StirrupsMiddle	2H10-200
StirrupsRight	2H10-200
StirrupsTypeLeft	Normal
StirrupsTypeMiddle	Normal
StirrupsTypeRight	Normal
TopLeft	2H13
TopMiddle	2H13
TopRight	4H25
SGPset_Material	



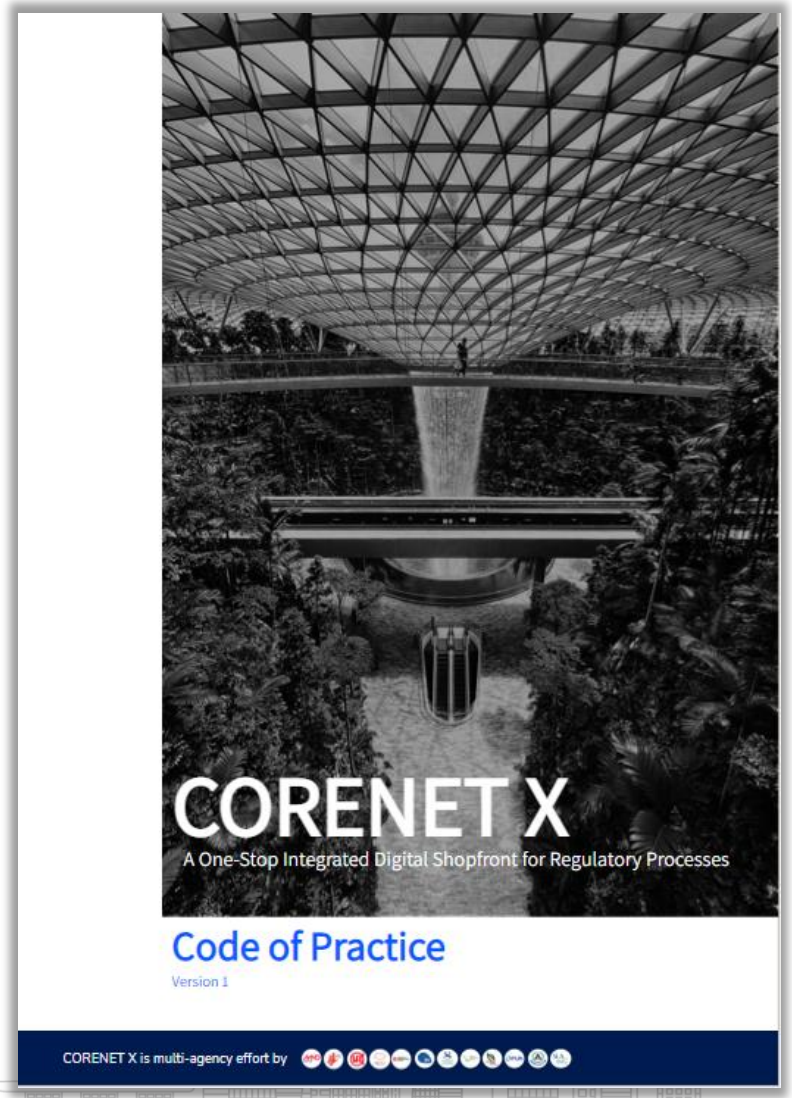
IFC Structure

Active	Type	Name
☑	Pile	Bored Pile:600mm Diamet...
☑	Pile	Bored Pile:600mm Diamet...
☑	Pile	Bored Pile:600mm Diamet...
√ ☑	Pile	Bored Pile:600mm Diamet...
☑	Pile	Bored Pile:600mm Diamet...

Properties | Location | Classification | Relations

Name	Value
SGPset_Material	
MaterialGrade	C32/40
SGPset_Pile	
BoreholeRef	BH2
ConstructionMethod	CIS
DA1-1_CompressionCapacity	3095
DA1-1_TensionCapacity	0
DA1-2_CompressionCapacity	2253
DA1-2_TensionCapacity	0
ReinforcementSteelGrade	500B
StructuralCompressionCapacity	2280
StructuralTensionCapacity	0
SGPset_PileDimension	
CutOffLevel_SHD	-2.725
Diameter	600
Length	12 500
Mark	PC5-2
SGPset_PileReinforcement	
MainRebar	6H20
PileType	Bored
ReinforcementLength	12
Stirrups	H10-300
SGPset_PileStructuralLoad	

Code of Practice



- **"When/What/How" to provide info for CORENET X submissions**
- **The Code of Practice provides the following:**
  - Overview of submission process
  - Overview of technological enablers
  - How to create, prepare and configure a model for IFC-SG submission
  - Information on submission requirements
- **Information on submission requirements are categorised by:**
  - Disciplines (Architecture, C&S, M&E)
  - Agency's requirements
  - Gateways
  - Building aspects (e.g. structural design, materials etc.)
  - Components (e.g. staircase, road, tree etc.)

Link- Code of Practice | Building and Construction Authority (BCA)

Code of Practice

SECTION 4

BIM Data Representation (IFC-SG) and Modelling Good Practice

Beam

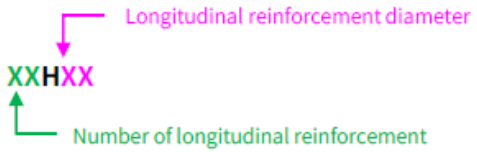
Beam Property Definition

Beam Property Definition	
1	Every beam will be detailed based on 3 p below).
2	Starting point of a beam should be the s
3	Behaviour of the beam (single, end, inte inputs for this parameter is applied. Plea

Column

Column Dimension and Reinforc

Column Dimension and Reinforcement Definiti	
1	The breadth is referring to the longest side of a despite of the column orientation.
2	QP may substantiate a set of 2D column sched illustration.
3	The input for MainRebar shall be "XXHXX" while diameter. • Use '+' for bundle column reinforcement (e.g. 12H32+12H25)



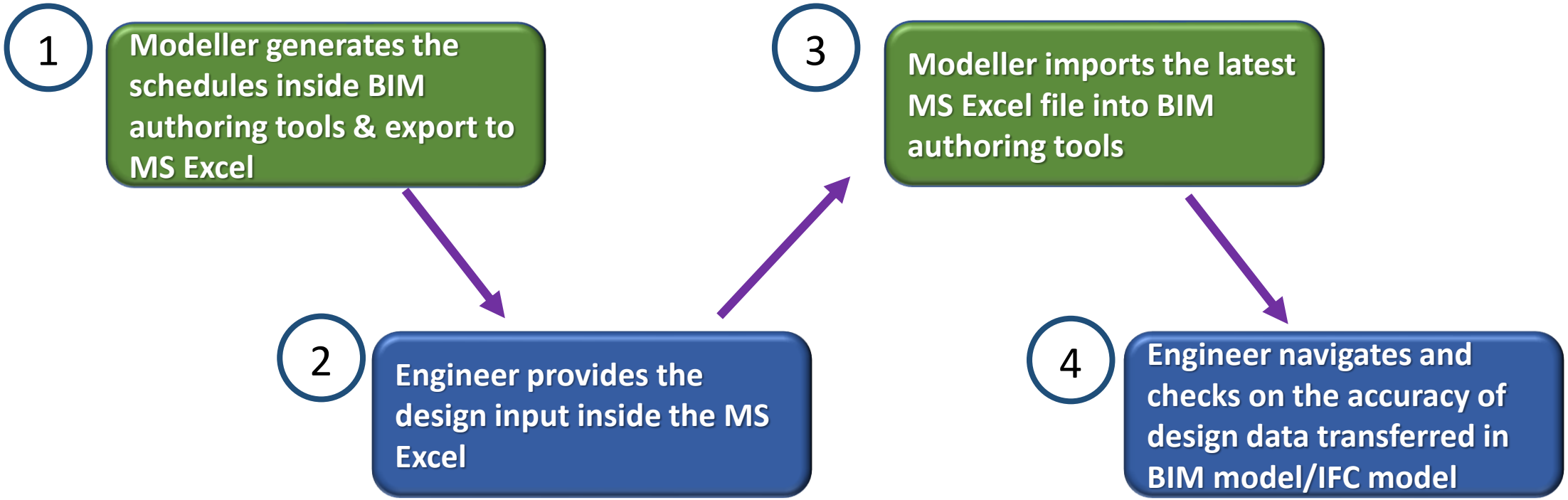
IFC Entity: IfcPile

IFC SubType: N.A.

S/N	IFC-SG Property	Property Type	Type of Elements	Unit	Input Limitation	Examples
1	MaterialGrade	Text	All piles	-	Yes	Refer to list^
2	BoreholeRef	Text	All piles	-	No	BH2, BH3, BH12-2
3	ConstructionMethod	Text	All piles	-	Yes	Refer to list^
4	DA1-1_CompressionCapacity	Integer	All piles	kN	No	5683
5	DA1-1_TensionCapacity	Integer	When required / relevant	kN	No	3655
6	DA1-2_CompressionCapacity	Integer	All piles	kN	No	4823
7	DA1-2_TensionCapacity	Integer	When required / relevant	kN	No	3025
8	MinEmbedmentIntoBearingLayer_SPT_MoreThan_100N	Real	When required / relevant	m	No	16.5
9	MinEmbedmentIntoBearingLayer_SPT_MoreThan_60N	Real	When required / relevant	m	No	23.2
10	MinRockSocketingLength	Real	When required / relevant	m	No	16.5
11	ReinforcementSteelGrade	Text	RC piles#	N/mm2	Yes	500B
12	StructuralCompressionCapacity	Integer	All piles	kN	No	6525
13	StructuralTensionCapacity	Integer	When required / relevant	kN	No	3825

Data transfer process

- The industry can make use of the free plug-in [Diroots/SheetLink] to import & export the data/information to be stored in BIM model.



Thank you!

Should you require any further clarification, you may submit your query at https://go.gov.sg/cxenquiry

https://go.gov.sg/cxenquiry