CORENET X
Good Practices Guidebook

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corenetx

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Preface

CORENET X Industry Guidebook is a compilation of the key learning points and observations of the projects that have been submitted to CORENET X. It is organised based on a project team's user journey and identify key areas that a project may go through in its preparation and submission process.

The CORENET X Industry Guidebook complements the:

1. CORENET X Code of Practice
   Submission requirements, including level of details required, across agencies at each submission milestones
2. IFC+SG Resource Kit
   Technical templates and help resources for the generation of IFC+SG models

Disclaimer

CORENET X Industry Guidebook is compiled based on key learning points and observations from actual projects. As each project's context and complexity may differ, the recommended good practices are provided as reference materials and are not meant to dictate and mandate any practices.

CORENET X's concept is based on the principle that the fruition of any building works from design, construction to completion is a teamwork among many built environment professionals. Therefore, it is important for project teams to adapt the recommended good practices based on the team composition and context of the project.

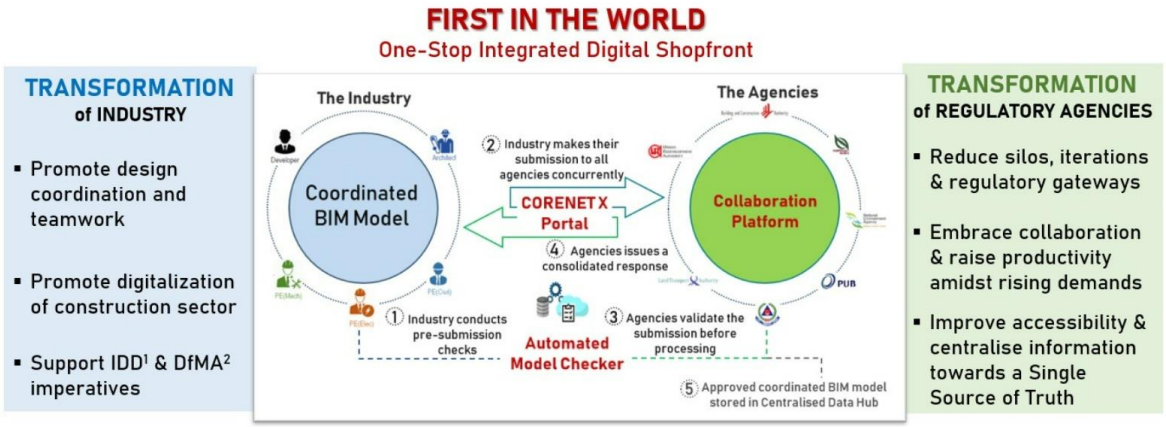
1 Background

CORENET X is an innovative digitalisation and technology-driven platform set to revolutionise the regulatory approval process for building works in Singapore and redefine Government-to-Business interactions as a One Stop Integrated Digital Shopfront. Initiated in 2018 and soft-launched on 18 Dec 2023, this cutting-edge system leverages Building Information Modelling (BIM) and automation to create a seamless, integrated experience for industry professionals.

CORENET X aims to promote greater collaboration and productive workflows for both the industry and public agencies, complementing ongoing efforts on Integrated Digital Delivery (IDD), which is a key component of the Built Environment Industry Transformation Map.

CORENET X will shift the current practice of consultants dealing separately with multiple agencies (and at times) using different versions of plans, to one where consultants come together, collaborate upfront to harmonise their designs, and produce one coordinated BIM model.

This collaborative system allows project teams to review designs together, identify potential conflicts before construction, and generate a coordinated BIM model for regulatory approval. CORENET X aims to streamline the regulatory approval process, replace the current practice of QPs dealing with multiple regulatory agencies separately and producing various versions of building plans.



[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 Submission Preparation

2.1 Industry Onboarding Checklist for Submission Portal

Stage	Task	Status	Remarks
Training	Access and complete hands-on training without an actual project through CORENET X Training Environment	☐	Familiarise with system and end-to-end workflow
Pre-registration	Identify Project Coordinator (PC) for the project. Refer to Section 4.1 for PC's roles and responsibilities.	☐	Must be appointed before project setup
	All project members -Developer, QPs and QP Assistants (QPAs) must be registered and authorised in the company's CorpPass account.	☐	Obtain authorisation in company's CorpPass account from CorpPass Admin (click here to find out who your CorpPass Admin is)
	Set up "CORENET X Submission Portal" access in CorpPass.	☐	Required for all project members
	Prepare required details of project- Development type, Building works, Project title, Address (MK/TS/Lot no.)	☐	Get all information ready before proceeding with registration
	Prepare required details of QPs- Name, Professional registration number, last 4 alphanumeric digit of NRIC and email address	☐	
	Prepare required details of Developer- Name, last 4 alphanumeric digit of NRIC and email address of the home-owner (if applicable)	☐	
	Define and assign roles and responsibilities within the project team across disciplines Refer here for the list of roles and responsibilities that can be undertaken by the different QPs.	☐	Outline clear roles and duties
Account Set Up	[For 1st time login] Complete profile setup in Submission Portal. Ensure designation is filled in	☐	This is a one-time requirement for QP.
	QPs to assign assistants and set project-specific access rights.	☐	Project access can be customised by QPs for individual assistants.
Project Set Up	Create project and appoint team members	☐	Include all required roles under each agency subsection
Submission & Payment	Input submission details in the form	☐	Complete each section in the joint-submission form.
	Upload files e.g. cover letter, supporting documents, 2D drawings to agency Tag each file to identify the required deliverables Ensure each file do not exceed 1GB Files should not be zipped		

Stage	Task	Status	Remarks
	Upload BIM models in the "Coordinated BIM" section Ensure each file do not exceed 1GB Files should not be zipped	☐	Submission ready for submission when all sections displayed a green tick.
	Review section	☐	Only after clicking on "Review section" submission inputs related to fee computation can be reflected
	Declaration by QPs	☐	Submission ready for submission when all sections displayed a green tick.
	Payment of fees to respective agencies	☐	Submissions will only be processed after all agencies receive payment
	Monitor submission status/timeline in Submission Milestone Dashboard	☐	

2.2 IFC+SG Onboarding Checklist

Note: Skip to task 5 if you are not a Revit user.

S/N	Task	Status	Remarks
BIM Authoring Software and Features			
1.	Ensure the latest Revit patch is installed	☐	Refer to link for details
2.	Ensure the latest Revit interoperability tool is installed	☐	Refer to link for details
3.	Ensure the Revit-IFC app is installed For Revit 2025 user > Please uninstall the above if you have issue activating the Revit-IFC dialog box > refer to link for details	☐	Refer to link for details
4.	Ensure the Revit IFC exporter is the latest version	☐	Refer to link for details
Component Creation and IFC+SG Information Population			
5.	Study the IFC+SG regulatory requirements for different gateways	☐	Refer to link for key gateways details Refer to link for Code of Practice (COP) details
6.	Study how to prepare an IFC+SG model Please refer to link for Glossary of Identified Components	☐	Refer to link for details
7.	Ensure you download relevant IFC+SG toolkits and resource files	☐	Refer to link for details
8.	Use third-party applications to help in IFC+SG model preparation	☐	Refer to link for details
9.	Be sure to read through the model submission good practice guide	☐	Refer to link for details
10.	Be sure to read through the multi-disciplinary coordination good practice guide	☐	Refer to link for details
11.	Be sure to read through the checking levels (z-coordinates) good practice guide	☐	Refer to link for details
12.	Be sure to review the exported federated IFC files before submission When using an IFC Viewer (BIMVision or BIMCollab Zoom), make sure it is the latest build. (Note: Registration may be required, but both viewers are free.) BIMVision > Click link to download BIMCollab Zoom > Click link to download Essential Points for Model Quality: - • Ensure IFC models can be federated together as intended. • Ensure components are exported to the correct IFC entity and subtype with the relevant IFC+SG properties and property sets. • Ensure there is only one IfcSite per IFC file when exporting with linked files.	☐	Refer to link for details

S/N	Task	Status	Remarks
	(Tip for Revit user: In the Revit IFC exporter > Additional Content tab > linked files, select 'Export in same IfcSite') • Ensure there are no unreferenced items. (Tip: Make sure all elements created in Revit are referenced to a level datum) ○ If you notice any unreferenced items, locate and resolve their referencing issues. (Tip for Revit User: When you encounter this warning while opening an IFC file in BIMVision, download the log and use the element ID (tag) or GUID to locate the elements in Revit) • Ensure all level datums are aligned across all models (i.e. datum names must be unique (including the GUIDs), with the same Finished Floor Level)		

3 Key Takeaways and Best Practices

Planning a Project

3.1 Project Planning and Coordination

Roles of Coordination

Within a project, the coordination is paramount. Easier said than done, most projects face some forms of miscommunication leading to tension. It is important to recognise that there are many forms of coordination required, and these are existing aspects that a project need to undertake to ensure successful project delivery.

1. Overall project management
2. Design coordination
3. Submission coordination
4. Other types of coordination

Design coordination and overall project coordination are two important aspects in CORENET X. As it spans across many stakeholders, these two areas of works are often underestimated and often the key reasons why projects trip over seemingly minor issues, whether it is with the main QPs, builders or specialised sub-contractors.

COMMON PITFALLS

Lack of clarity on the scope of work
No consensus over who is leading the overall coordinator. Architect and Builder each felt that the other party should be the coordinator.

Design Coordination
No discussion among QPs over design change and its potential impacts. E.g.: A shift in layout by the Architect could result in C&S engineer having to redo his structural calculation and M&E engineer to redesign the services.

Overall Project Coordination
When a QP for a specialist work needed to furnish additional document to the agency, he was unfamiliar how to do it. As Specialist QP was engaged under the builder, the QP (in this case M&E QP) opined that it is not his responsibility to assist or ensure the submission is done successfully, resulting in delay in the approval process.

Overall Project Coordination involves coordinating among various project parties to ensure the respective inputs and actions are provided in a timely manner. This includes overseeing the overall project schedules and understanding the dependency between submissions and between submission and site activities.

Design Coordination, on the other hand, ensure the design and planning of the building works are coordinated and meet the various requirements. The party overseeing the design coordination has the responsibility to ensure submission quality and highlight/ resolve any design conflicts.

> ***Good Practices: Ensure clarity in scopes of works***
> *Depending on the contract, the developer (or the appropriate party) should provide clarity over who should lead the design and overall project coordination respectively. These are NOT a single person or single firm's role. It is a collective responsibility, and it is important to identify:*
> 1. *The overall lead coordinator(s)*
> 2. *A representative for each firm who will work with lead coordinator(s) and responsible for alignment within*

3.2 Timeline Management

The new regulatory approval process introduces a fundamental shift in project scheduling and planning. Early planning and achievable timelines are now essential components for successful project delivery.

Project teams should establish a well-structured timeline that allocates sufficient duration for design development and coordination. This includes setting clear design freeze milestones to minimise rework and optimise approval timelines. Learnings from pilot projects have demonstrated that projects with adequate design periods consistently achieve better outcomes, while compressed schedules often result in submission quality issues that require extensive revisions.

To ensure successful project delivery, developers and project teams should:

- Allocate realistic timeframes for design development
- Factor in sufficient coordination periods between disciplines
- Establish clear design freeze milestones
- Build in adequate time for internal reviews before submissions
- Account for potential revision cycles in the project schedule

This proactive approach to timeline management helps teams deliver coordinated, high-quality submissions that align with regulatory requirements and facilitate smoother approvals.

> ***Good Practices: Ensure clarity in scopes of works***
> *The timeline should be agreed within the entire project team and sufficient time should be set aside for preparation, design and coordination. Where pre-submission consultation or waivers are required, the planning should include such activities and cater for buffer.*

COMMON PITFALLS

Insufficient cater for submission preparation

When an unrealistic timeline was set, the QPs would rush for submission. This often compromises submission quality, which could impede processing and leads to unnecessary iteration incurred.

Late submission of waiver

Under CORENET X with upfront design and coordination, if there is intent to deviate from the requirements, it is important to cater time for waiver application or pre-submission consultation.
In one project, QP refers to the current practices and assumes that the waiver can be done later as 'agency will accept it anyway'.

3.3 Design Changes

Design Freeze

As with any project, the timeline will be severely affected if the project team does not firm up the design. Frequent design changes with no control will negatively affect the project schedule. This is especially the case when design changes are being introduced halfway during the review process. When such changes happen, it entails a reset to the review process.

Good Practices: Minimising frequent design changes

Frequent design changes through the project will lead to inefficiency and abortive work. Therefore, it is important to set a deadline and impose a design freeze for the project. This provides certainty for the project teams as they work towards getting the plans approved.

Early Contractor Involvement

If the project team intends to engage the builder to provide inputs for the design (i.e. value engineering), the builder should be engaged early and not halfway through the project and after the design have commenced.

Good Practices: Involve the Contractor early

Builders are important stakeholders in the project. For a well-executed project, most builders provide good advice. Therefore, it is important to involve the contractor early so that any comments can be incorporated early.

COMMON PITFALLS

Frequent design changes during submission

Developer was making changes throughout submission process, resulting in new design being submitted during resubmission. This prolonged the approval timeline

Inputs from Builder came midway during design

While there is plan to involve the contractor early, the contactor was involved halfway when the design is near completion. The consultants had to redesign to incorporate the contactor's inputs, resulting in abortive works.

3.4 Dependency that may Affect Site Progress

It is important to understand the dependency between submissions and submissions that affect site progress.

Recognizing the **dependency between submissions** help the project team plans the project timeline and understand better how to navigate the submission process.

Demolition *vs* New Erection

Demolition and new erection proposal can proceed concurrently. Demolition is joint application to both URA and BCA. While URA allows the demolition works to proceed, BCA reviews the demolition plan.

Gateway Process

Design Gateway marks the commencement of the regulatory approval process and consists of URA's Provisional Permission and agencies' Development Control clearance. This is essential before Piling (PG) Gateway and Construction Gateway (CG) to proceed.

Piling Gateway's dependency with Design Gateway

- Draft submission may be created any time after DG draft submission is created
- Submission may proceed concurrently while DG is being processed.
- PG will only be approved after DG is cleared.

Construction Gateway's dependency with Design Gateway

- Draft submission may be created any time after DG draft submission is created
- Submission may proceed only after DG's clearance.

> ***Good Practices: Understand these dependencies and maximise them***
> *Make full use of these to plan for your project timeline/ schedule. While the earlier submission is ongoing, firm up the rest and start the preparation early. This requires close coordination between the consultants.*

COMMON PITFALLS

Learning points from voluntary submissions

These changes and review of process are made following key observations from voluntary submissions. It helps to relieve time pressure by reducing dependencies between submissions.

Dependency below Submission and Site Progress

It is important to take note of submission that affects site progress, considering time required for off-site activities, such as precast.

If the project is eligible for Part ST submission,

- Plan your Part ST packages well. For projects eligible for Part ST submission, please note that pre-submission consultation is required to discuss your part ST planning.
- CG must consist of full Structural, Architectural and MEP models with accompanying detailed structural calculation of part 1 and AC/ACO's calculation. The structural submissions of the remaining parts of the project may be submitted as independent ST submissions.
- As the CG submission is a joint coordinated submission across disciplines, it must be cleared before the remaining part ST submissions may be approved.

CG submission vs remaining part ST submissions

- Part ST submission for the remaining parts of the project will be submitted as independent submission and its draft can be created any time.
- Part ST submissions may proceed while CG is being cleared.
- However it can only be approved after CG (which is the overall coordinated plans/ model) is cleared.

> ***Good Practices: Plan the project schedule considering these dependencies***
>
> *Discuss with your QP (Structural) and builder to plan the project schedule. If extensive off-site activities are involved and lead time is required, consider covering the scope early in the submission timeline.*

COMMON PITFALLS

Project planning did not cater for submissions needed for off-site activities

To carry out off-site activities such as pre-cast, BCA's Structural submissions and Permit to commence structural works are required. Projects may face delayed if they do not cater for this in their planning for part ST submission.

Making a submission

3.5 Navigating Submission Portal

It is important to note that the new CORENET X Submission Portal and CORENET 2 are different. While these are administrative matters, they are often the details are overlooked and caused expected delays.

In line with the digitalisation efforts and move away from wet-ink signature, many workflows would be digitalised under CORENET X.

Key Changes under CORENET X

1. Most project team members are required to interact with CORENET X. This includes members who are not required to interact with CORENET 2.

   Examples include developers, Accredited Checkers/ Accredited Checking Organisations, Resident Engineer, Resident Technical Officers

2. For project members interacting with the CORENET X portal representing their firms, Singpass Business is required.

3. The appointment of project members workflow by developer or builder (in the case of Design & Build) is fully digitalised. While the Project Coordinator (lead QP usually undertaken by Architect) will prepare the information, developer is required to access CORENET X to authorise this process.

> ***Good Practices: Preparation to onboard the portal***
>
> 1. *For project members using Singpass Business, work with your firm's Corppass Admin to ensure your account is set up to access CORENET X.*
> 2. *Once a project is created, login to ensure you can access the project.*
> 3. *Always ensure your professional registration details are up-to-date.*

COMMON PITFALLS

Did not set up Singpass Business early

To use Singpass Business, the firm must first have a Corppass account. The Corppass Admin needs to grant access for the individuals to interact with CORENET X on behalf of the firm via Corppass portal. Most project members either did not prepare this or did not know who their Corppass Admin is. Most projects underestimate this step as some larger entities have internal clearance process before this can be done.

Overlook to onboard the project

When a project is first created, the Project Coordinator will provide the members' details. An invitation link will then be sent to the respective members. It is important to confirm this addition by performing a first login. This is part of the system security design to capture the member's digital identity for authentication of future login.

Failure to update professional registration

System will validate the details of the professional registration. Licensed builder did not update the AP and TC, resulting in delay.

Plan the Project TOP/CSC Journey Early

In line with the overall digitalisation move, regulatory forms and submissions will move away from the use of wet-ink signatures. Currently under CORENET 2, there are many forms that allows project members to declare and sign on the forms and the QP collates and includes these documents to the respective agencies.

Moving forward, under CORENET X, such declarations will be done digitally via CORENET X. This means that the project member will need to login to CORENET X via Singpass Business and make the online declaration.

Some of these members may not be users of current CORENET 2. Therefore, it is important to ensure they are aware of the expectation to minimise any potential delays due to miscommunication. As construction spans over years, there may be a long period of inactivity for some project members between the initial involvement with CORENET X Submission Portal to later stage at TOP/CSC. This often leads to delay as the Project Member is not aware of actions required of him/ her at TOP/CSC. One example is PE (Electrical) for the submission of Certificate of Supervision (COS) of Lightning Protection System. Most PEs assumed that COS would still be via hardcopy forms.

Good Practices: Plan Ahead for TOP/CSC

As the project nears completion, it is important to start the preparation early and informed the relevant project members of the actions required.

CORENET X Submission Portal provides a TOP/CSC status dashboard showing the progress of technical clearances and documentations required. Make full use of the dashboard to plan your TOP/CSC process.

COMMON PITFALLS

QP was informed late to make his/ her submission required for TOP/ CSC

In a few projects, the project team overlooks the involvement of PE(Electrical) to submit his/ her Certification of Supervision for Lightning Protection System, leading to additional time taken to wait for this submission and delay the TOP/ CSC process.

Late Submission to BCA for TOP requirements, after all other technical clearances are obtained. This leads to delay to overall TOP/CSC

As BCA performs gatekeeping for technical agencies before the overall TOP/ CSC may be issued, many project teams only submit BCA TOP requirements at a very late stage. Under CORENET X, project team should concurrently clear BCA TOP requirements ahead of the overall TOP/CSC. This will ensure a more expeditious process towards TOP/ CSC.

3.6 Submission Process & Statutory Responsibility

To support the coordinated workflows, CORENET X submissions consist of joint submissions and independent submissions. It is important to be clear the project members involved to ensure a seamless submission.

Type of submission	Involvement
Gateway Submission	
Gateway Submission (eg: DG, PG, CG)	One or more QPs One or more Agencies
Direct Submission Process (DSP) - Joint Plan Submission	One or more QPs One or more Agencies
Independent Submission	
Joint independent submissions (eg: demolition, external works)	One or more QPs One or more Agencies
Agency Specific joint independent submission (eg: ST plan and Permit, Completion of Works)	One or more project members Submission to 1 agency
Agency Specific Independent Submission	One QP Submission to 1 agency

Statutory Responsibility of project member

As a digital platform supporting regulatory submission, it is crucial and important to ensure that the inputs from the respective professionals are clearly distinguished.

To do so, the CORENET X Submission Portal would require the list of professionals to be identified, added to the project and assigned their statutory responsibilities, i.e. types of plans/ submissions that they would be responsible to the respective agency. To facilitate this process, the CORENET X Submission Portal requires the Project Coordinator,

COMMON PITFALLS

Lack of Clarity over who should be responsible for an agency submission

As the person who assists to set up the project and submission is usually the QP Assistant (QPA), he/ she may not be clear the agreed scope of work and statutory responsibility. As the assigned scope will affect access to respective parts of the submission, it is important to ensure clarity in this.

Initiating multiple requests to developer for members' appointments

The system notifies the person whose action is required. In one project, the QP Assistant sent off the appointment request of each added member to the developer individually, leading to the developer receiving multiple emails.

a system role identified to oversees the administrative set up of the project, to provide this information. Once the information is ready, the Project Coordinator will then initiate the appointment process by sending the list to the developer (or builder depending on the project) for the roles to be appointed under the respective Acts and Regulations.

Once completed, the system will provide the necessary access control to the various forms and functions based on the project member's appointed responsibilities. For example, an Architect cannot make a Structural Submission or amend the Structural aspects provided by the Professional Engineer.

> ***Good Practices: Preparation for submission and Scope of Responsibility***
>
> *Align within the project team to ensure there is clarity over each project members' scope as it affects their access to relevant aspects of the submission. You may refer to https://info.corenet.gov.sg/overview/corenet-x-submission-portal/appointing-project-members to guide your project.*
>
> *The Person preparing this appointment process could complete the preparation before initiating the appointment process. The system will then consolidate the request and send only 1 email notification to the intended party.*

Digital Signing

CORENET X login mechanism is Singpass and actions and declarations made within the system will be identified based on the digital identity.

However for plans and documents (eg: calculation) that are prepared outside the systems, Netrust Digital Signing is still required. This is to ensure the integrity of the files during uploading and submissions

Good Practices: Digital Signing of Plans and Documents for approval

Ensure the timely renewal of the Netrust Digital Signing Certificate to ensure its validity. All Plans and Documents meant for approval are required digitally signed using Netrust.

COMMON PITFALLS

Missing Digital Signing

As plans and documents are important items for submission, it is necessary for them to be digitally signed by the QP using the Netrust token. This is often overlooked and affect the approval process.

Expired Netrust Digital Signing Certification

Netrust supports and provides the digital signing certification for registered professionals. It is necessary to ensure its certification is valid. In one project, due to the expiry of the digital signing certificate, it leads to issues with the digital signing process.

Long filepath

File located in multiple levels of sub-folders may cause error during encryption e.g. XX\XX\XX\[File Name]

3.7 Submission Quality

Submission quality plays a pivotal role in ensuring timely approvals through CORENET X. Well-prepared submissions that meet all requirements enable efficient processing and reduce the need for clarifications. This will help reduce unnecessary iterations and prevent prolonged delays in the processing timeline.

Responding to Written Directions (WD)

Responding effectively to WD is key to timely approvals. When preparing for resubmission, project team should take time to check that all documents are complete and every previous comment has been properly addressed. Generic replies such as 'complied with' or 'noted' are insufficient and may lead to additional queries. Instead, provide detailed explanations that clearly demonstrate how each issue has been resolved.

Perform Visual Model Quality Checks Before Submission

Conducting pre-submission model checks is a crucial quality control measure. Project teams should conduct a systematic visual inspection, which includes visual checks on the model using different viewing angles and ensuring the models could federate properly. This initial check can help identify obvious issues and reduce the likelihood of receiving WDs, ensuring a smoother approval process. For detailed model quality check, please refer to section 3.10.

> ***Good Practices: Pre-Submission Quality Checks***
> *Project teams should conduct thorough quality checks before submission. Review all drawings and models thoroughly, ensuring document completeness and accuracy. When addressing comments, provide clear responses that detail the changes made and where to find them to facilitate processing.*

COMMON PITFALLS

Lack of clarity in correspondence

Some project teams did not fully address agencies' Written Direction comments even after two submission iterations. This incomplete compliance has necessitated additional working sessions with agencies, resulting in extended processing timelines and possibly delayed approvals.

Skipped model checks before submission

Project teams who skip quality checks often submit models with obvious issues. Such errors hinder the agencies' review process and typically result in WD, extending processing timelines unnecessarily. Examples include:

- Incomplete model (eg: missing roof) as the QP forgets to attach 1 file.
- Federation issue resulting in parts of the models (eg: drain) 'floating' above the ground
- Federation issue resulting in disjointed tower block and podium.

Basic visual inspections of the models could help identify such issues and project teams should fix them prior to submission.

3.8 Level of details required for M&E Aspect

The level of M&E details within a project may vary depending on project typologies. Coordination across disciplines is important and crucial for projects. A development's functionality depends on services, ranging from sewerage/ sanitary routing to ventilation, and hence is an important aspect that should not be neglected even as the building form is firmed out. This relies on close collaboration among the Architect, C&S Engineer and M&E Engineer.

LEARNING POINTS

Models that are overloaded with details not required at the gateway, leading to long export time by the QP. As IFC+SG models require export from BIM authoring software, huge models can lead to long export duration. As a result, some QPs experience long export duration, that may be in the range of hours.

Understanding the aspects that are essential for regulatory purposes

While it is ideal to provide all the information, a set of overly huge models containing information not required at the gateway can lead to performance issue and affect the processing of the submission. There is hence a need to strike a balance between the exact details available and the optimal level of details to be provided. To do so, it is important to understand the rationales of the regulatory requirement to determine the level of information to be provided.

<u>Submission of M&E aspects that are directly regulated</u>

Aspects of M&E that are regulated will need to be modelled as per the CORENET X Code of Practice and provided for in the submission. Examples include Drainage Aspects (PUB), Sewerage and Sanitary (PUB) and Exhaust for carpark, toilets and kitchens (NEA).

At early stage, some project teams may prefer to model all M&E services to coordinate between disciplines to ensure compliance when all services are considered. One example is the provision of M&E internal services, eg: ACMV piping, routing of sewerage piping, water supplies etc. Provision of these services and the details routing affect the ceiling height and headroom of the spaces, which in turn are related to compliance with regulatory requirements, such as ceiling height and headroom to BCA and headroom of carpark spaces for LTA. For regulatory submission, while it is possible to submit all the M&E models, it will inevitably affect the time taken to export the BIM models to IFC+SG, and if the project is large, the model size may become unmanageable. To balance this, it is not necessary to provide the full details for purpose of submission. Project team can continue to coordinate in the native environment and export only the necessary for regulatory submission to IFC+SG.

Managing BIM models of the M&E servives

It is not necessary to bind all the M&E services in separate BIM models into 1 large BIM file. Effective coordination of M&E services with fellow disciplines can be achieved via federation of BIM models which can be done in all BIM authoring software and viewers. Typically, different M&E services would be modelled in separate files for effective management of each service. If the team prefers to combine multiple M&E services in 1 BIM file, QPs should assess whether this approach is manageable and sustainable for subsequent collaboration with other disciplines and version control.

> ***Good Practices: Strike a balance between the exact details available and the optimal level of information to be provided for submission***
>
> *To overcome and manage the long export duration faced by many QPs for the model conversion process into openBIM format (i.e. IFC+SG), QPs need not furnish the full details but only essential information for regulatory compliance.*
>
> *The intent of CORENET X is not about front-loading the requirements but to ensure all disciplines are considered and coordinated during their design stage and when seeking approval from authorities. This prevents the situation of overlooking one aspect leading to issues and costly reworks during construction.*

Modelling for IFC+SG

3.9 Model Federation

CORENET X requires joint submission to enable project members to collaborate and ensure all design aspects are coordinated. Therefore, it is crucial that the various models federate effectively. As CORENET X adopts IFC+SG, ensuring models federate without issues is essential.

A federated model refers to the integration of separate discipline-specific models such as architectural, structural, mechanical, electrical, and plumbing into a single coordinated digital environment. This process does not merge the models into one file but rather links them together to allow cross-discipline coordination and review. This multidisciplinary integration is critical for identifying design clashes, ensuring spatial consistency, and improving overall model accuracy.

For regulatory agencies, the IFC+SG federated model acts as a single source of truth, enabling different authorities to review the project from a unified and consistent perspective. This not only streamlines regulatory compliance checks but also enhances transparency, reduces duplicated effort, and supports faster and more accurate approvals across multiple agencies. This is why setting up an agreed project reference point is important to ensure all discipline models align correctly within the federated environment.

> ***Good Practices: Establishing and Maintaining Common Reference Points for Multi-Disciplinary BIM Models***
>
> *Establish a common project reference point at project start, ensuring all discipline models align within the same coordinate system for accurate federation. Any changes to the reference point require immediate notification to the BIM teams to maintain coordination accuracy across all models.*

COMMON PITFALLS

Lack of Coordination in Initial Setup

Project teams failing to establish and document agreed-upon coordinate settings during project kick-off leads to models being created with different reference points and orientations, causing significant coordination issues downstream.

Poor Communication of Reference Point Changes

When project reference points are modified without proper notification to all stakeholders, teams continue working with outdated coordinates, resulting in misaligned models.

3.10 Alignment of Levels and Zones

For CORENET X submission, it is crucial to ensure that storey names and heights ("Z" values), specifically Finished Floor Levels (FFL), are consistent and uniquely defined across all discipline-specific BIM models, including architectural, structural, and MEP models. Each storey should also retain a unique and consistent GUID (Globally Unique Identifier) across all models to support data integrity and accurate model referencing. For example:

- File A (Architecture):
"1st Storey" - GUID: 3f7c4e8a-9b2d-11ed-a8fc
- File B (Structure):
"1st Storey" - GUID: 8d2e5f9b-3c4a-12fg-b9de
- File C (MEP):
"1st Storey" - GUID: 2k7h4j5l-6m8n-09op-q1rs

The storey names and FFL values must be identical across all models to ensure accurate stacking, seamless coordination, and effective regulatory checks within the CORENET X platform. Any discrepancies in storey naming or FFL values between disciplines can lead to translation misalignment, confusing presentation, or delays in regulatory approval.

Therefore, project teams must establish and adhere to a standardised storey naming convention, FFL reference, and GUID management strategy from the project's start, ensuring strict application across all disciplines.

> ***Good Practices: Standardisation of Storey Naming and Finished Floor Levels (FFL) and height***
> *To define and maintain a centralized standard for storey naming, height ("Z" value) and Finished Floor Levels (FFL) that all disciplines consistently apply throughout the project. Using shared reference files help prevent discrepancies and ensures alignment across all models.*

COMMON PITFALLS

Lack of communication between project team

Inconsistent storey names and FFL across models, often caused by poor communication between disciplines and the absence of a shared storey reference. When teams work in isolation or apply changes without coordination

Overlooked workflow to manage changes

No proper workflow in place to manage changes in storey name, FFL, and height, which can lead to inconsistencies across discipline.

3.11 Modelling – Model Quality

Across CORENET X submission gateways, poor modelling quality frequently leads to non-compliance with the COP and IFC+SG requirements. Common issues include missing components, unreferenced objects, incorrect IFC entity assignments, incomplete property sets and inappropriate IFC object types (subtypes) etc. These deficiencies cause regulatory compliance checks by agencies to fail, prompting written directions for model corrections resulting in avoidable delays and rework. Rigorous quality assurance during model development and prior to submission is essential to ensure full adherence to the COP and IFC+SG standards, thereby facilitating smooth regulatory approvals.

Conducting model quality checks before submission helps identify and resolve issues such as missing components, incorrect IFC+SG classifications, or incomplete property sets early on. This proactive approach minimizes the risk of non-compliance and prevents unnecessary rework or written directions from agencies. When combined with the use of IFC+SG validator tools and collaborative workflows, this gateway-specific understanding promotes smoother submissions and supports timely regulatory approvals.

COMMON PITFALLS

Lack of Early Coordination Among Disciplines

BIM teams across different disciplines often work in silos, leading to misaligned workflows and inconsistent model outputs.

Resistance to Adopting New BIM Workflows

Project teams may attempt to apply outdated practices to current CORENET X requirements.

Weak Collaboration Between QPs and BIM Teams

When QPs are not actively engaged with the BIM team, there is a risk of misinterpreting design intent or overlooking compliance issues.

Good Practices: Strengthening Model Quality Through Early Coordination

Early and close collaboration among all project disciplines is essential. BIM teams should jointly plan modelling workflows, avoiding siloed efforts that lead to inconsistent outputs. An open mindset is needed to adapt to updated workflows aligned with IFC+SG requirements. QPs must stay engaged with the BIM team to ensure models reflect design intent and meet regulatory expectations.

4 Annex

4.1 Annex A- Useful Resources and Links

SN.	Item	Link
1	CORENET X Website	https://go.gov.sg/cx
2	CORENET X Code of Practice	https://go.gov.sg/cxcodeofpractice
3	CORNET X Helpdesk	https://go.gov.sg/cxhelpdesk
4	Training Courses	https://go.gov.sg/cxtrainingcourses
5	Training Environment for Simulated Hands-on	https://go.gov.sg/cxtrainingenv
6	FAQ	https://go.gov.sg/cxfaq