Cross-Discipline Coordination for CORENET X (A joint study by SIA & ACES)

ASSOCIATION OF
CONSULTING ENGINEERS
SINGAPORE

ACES-SIA General Consensus

CX Focus workgroup discussion

OBJECTIVE

Addressing the challenges of synchronization of MEP design development and RABW "Regulatory Approval Process for Building Works" in CORENET X key gateways submission process.

Majority of MEP submissions are currently treated as **independent submissions**. There is a risk that the MEP design activities are conducted out of sequence and not in parallel with each of the gateway submission. This will impact not only the MEP design but also the other disciplines' interrelated design and submissions.

The workgroup had discussed the challenges in detail and identified the following approach and good practice for further discussion and refinement.

1. Preliminary MEP design will need to be carried out during Design and Construction Gateway
2. There will be a need for Design Change and Management Protocol
3. More Support and Training will be required to enhance design workflow and management skill

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Preliminary
MEP System and Services Design

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ACES-SIA General Consensus

CX Focus workgroup discussion – Preliminary MEP Design

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The MEP design is not an isolated process, a best guess, or something that should be conducted at a later stage.

“Preliminary design of MEP services” should be carried out during the Design Gateway and substantially completed by the Construction Gateway to the best interest of the process and productivity, forming a crucial design milestone.

This ensures that critical design data and parameters which include main MEP system c/w equipment capacities (e.g., MEP plant room size and logical arrangement) are established and synchronized with other design disciplines.

Additionally, major service routing and dimension for both vertical (e.g. risers coordination) and horizontal distribution (e.g., ceiling space coordination), which require special coordination shall be included.

The key take-away here is MEP system design need to be involved upfront, beginning from DG, and the main focus should be on spatial provisions leading to the CG approval. Thereafter, the MEP design will continue to be developed into the “independent submissions”.

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CX Focus workgroup discussion – Preliminary MEP Design

At the onset of the Corenet X implementation, ACES has already expressed concerns that there will be too much demand for M&E details upfront, making it impossible for the industry to complete the CG submission, hence delaying the approval.

In order to strike a balance on the extent of involvement and time impact, the consensus between BCA and the approving agencies in principles are that:

a) Only spatial provision required by the MEP services/equipment need to be set aside during planning stage. If agencies were to impose requirements at the DG/CG, general guidance is to request for spatial provision instead of full details

b) Details/spec can be developed and furnished during **Independent Submissions** so that these details will not hold back critical approval stages

c) Agencies should not “over-ask” for requirements and will be conscious of industry practice, e.g: it will not be reasonable to ask for sub-contractors details at DG or even CG (where in some cases the main contractor is not even appointed yet)

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Preliminary Design of MEP System and Services

When and what are minimally required?

Objective is to ensure that critical design data and parameters are established and synchronized with other design development.

MEP plant room size, service riser

Logical arrangement

Major service routing
[e.g. Main Ductwork, Pipework, Cable Containment]

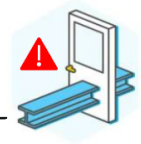
Both Vertical and Horizontal Distribution
in
BIM

Enable – Necessary Spatial Coordination

Multi-Disciplinary Coordination

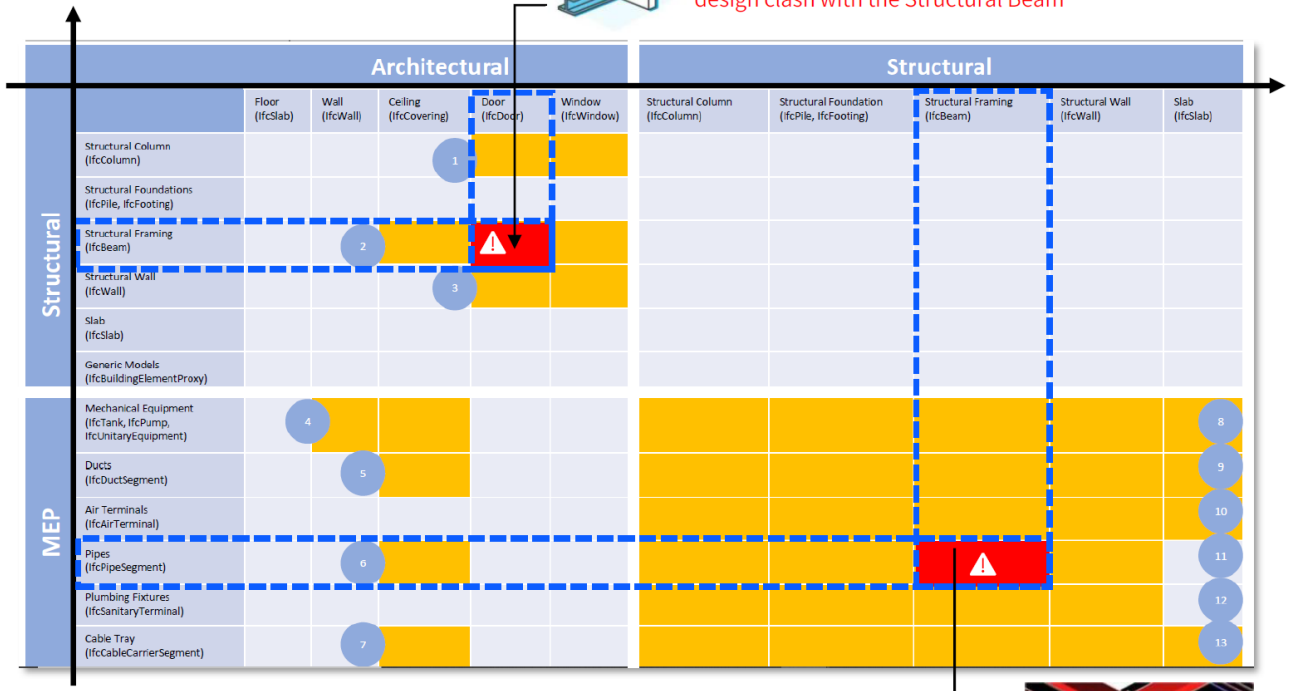
Clash Detection

Prior to submission, models by the relevant disciplines should be coordinated, and the project team should ensure that in-principle, basic / key components from each discipline do not clash with one another, as indicated in the component clashes matrix below.



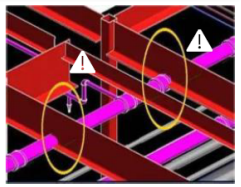
S2 – Fig 1 : Design Clash
Source: https://www.bimcollab.com/en/products/bimcollab-zoom-b/

For example, the Architectural Door should **not** have a design clash with the Structural Beam



S2 – Fig 2: Multi-Disciplinary Coordination

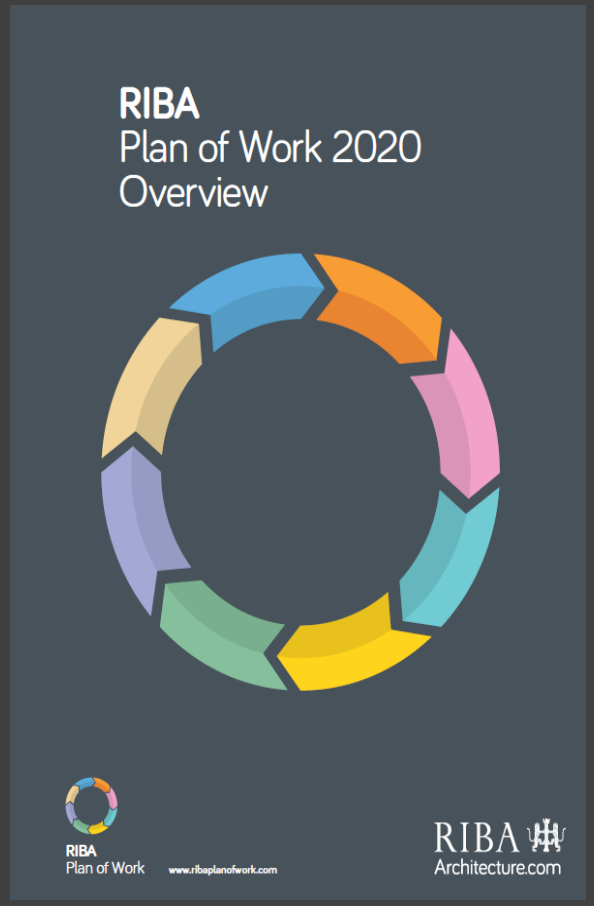
For example, the MEP Pipes should **not** have a design clash with the Structural Beam



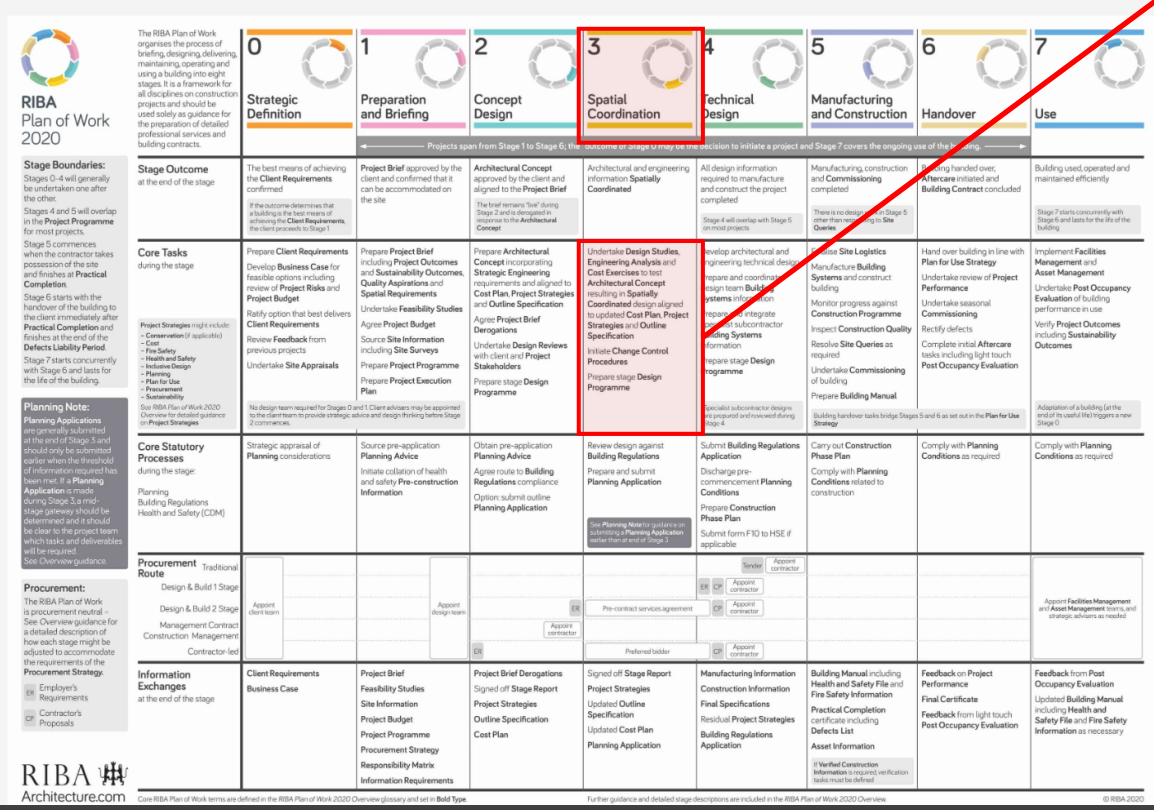
S2 – Fig 3 : Design Clash
Photo credit: Clash Detection Projects | Tesla CAD UK

Case Study – RIBA – Plan of Work

Reference – Royal Institute of British Architects



- Stage 0: Strategic Definition
- Stage 1: Preparation and Briefing
- Stage 2: Concept Design
- Stage 3: Spatial Coordination
- Stage 4: Technical Design
- Stage 5: Manufacturing and Construction
- Stage 6: Handover
- Stage 7: Use



Stage 3

Spatial Coordination

Term/task	**Definition** (guidance is included in grey boxes)
Engineering Analysis	The detailed calculations and analysis required to progress each engineering aspect of the project. During Stage 3, this analysis needs to focus on ensuring that the building is **Spatially Coordinated** by the end of the stage. Where **Engineering Analysis** does not impact on the Stage 3 design, it can be undertaken at Stage 4, when each **Building System** is detailed. Once the **Architectural Concept** has been signed off, the engineering teams can begin more detailed calculation and analysis exercises at Stage 3, confident that the direction of design travel is robust. With the increasing complexity created by topics such as the circular economy and growing demands to reduce buildings' contributions to climate change, it is useful for the design team to have a space in which to undertake their work, confident that a further iteration of the design will not require calculations to be reworked or strategies to be revised. In addition, the increasing numbers of specialist consultants on a project require the lead designer to oversee a large number of **Project Strategies**, many of which have overlapping themes, and coordinate everyone's efforts for the **Stage Report**. In this sense, Stage 3 is the lead designer's space. Any client involvement should be minimal, with an emphasis on the **Design Reviews** generated by the **Design Studies**, as the design team bridges the gap between the **Architectural Concept** and the production of **Manufacturing Information** and **Construction Information** at Stage 4.
Spatially Coordinated	Design in which the client's **Spatial Requirements** and the spaces required for any **Building Systems** – such as structural and building services engineering aspects, including grids, risers and plant rooms – have been determined and fixed to allow Stage 4 to progress without any further iterations. Stage 3 provides a bridge between the strategic outputs of Stage 2 and the significant detail produced at Stage 4. During Stage 3, further layers of detail are added to the design. The core goal of Stage 3 is a design that is **Spatially Coordinated**. This stage has two key aims. First, it allows each **Building System** to be developed independently at Stage 4. Second, a **Planning Application** can be made with the certainty that changes will not be required once planning consent has been granted. Coordination is a continual process throughout all of the design stages. This might involve coordinating the client documents with the emerging design; for example, adjusting the **Project Brief** to align with an aspect of the design. However, **Spatial Coordination** principally relates to the ongoing coordination of the design by the lead designer, and includes the tasks of coordinating the **Project Strategies** and designs of the different design team members. The lead designer needs to coordinate design efforts and the direction of the design team throughout every design stage, and individual designers must also coordinate their own efforts. For example, at Stage 4, the building services engineer must ensure that the various services installed above the ceilings have been correctly coordinated in the zone set out for all services during Stage 3 as part of the **Engineering Analysis** contributions. Defining **Spatially Coordinated** is difficult; however, it is fundamentally about ensuring that every space in a building is conclusively defined, from the client's functional spaces, such as living rooms, classrooms, operating theatres or departure lounges, to the spaces required for building services including plant rooms and risers. Simply put, if all of a building's spaces are not determined during Stage 3 it can cause a great deal of disruption during Stage 4, as designers discover that areas of a building are in a state of flux precisely when they are undertaking the detailed design of every **Building System**.

Design Responsibility Matrix incorporating Information Exchanges

Guidance on selection of aspects of design
(Tip: To hide this row right click on the row and select 'hide')

The aspects of design should be titled and coded using the Uniclass classification tables for items such as spaces, elements, systems and products, as appropriate. Further information can be found on the NBS website [1]. Technical support articles are provided on on classification [2], and LOD and LOI [3], [4].

Uniclass is aligned to ISO 12006-2 [5], and was in part funded by Innovate UK on behalf of the UK Government's BIM Task Group. (All websites are listed in the 'Useful links' worksheet in this document)

	2 - Concept Design			3 - Spatial Coordination			4- Technical Design			4 - Technical Design				
Aspect of design	**Design team**			**Design team**			**Design team**			**Contractor**			**Building contractor**	
Classification	**Title**	**Design responsibility**	**Level of detail (LOD)**	**Level of information (LOI)**	**Design responsibility**	**Level of detail (LOD)**	**Level of information (LOI)**	**Design responsibility**	**Level of detail (LOD)**	**Level of information (LOI)**	**Design responsibility**	**Level of detail (LOD)**	**Level of information (LOI)**	**Contractor's designed portion**	**Collateral Warranty required?**
Ss_55_70_97	Water reclamation systems														
Ss_55_70_98	Water treatment systems														
Ss_60 - HEATING, COOLING AND REFRIGERATION SYSTEMS															
Ss_60_40_15	Combined heating, cooling and power														
Ss_60_40_17	Cooling systems														
Ss_60_40_36	Heat pump systems														
Ss_60_40_37	Heating systems														
Ss_60_60_15	Cold room systems														
Ss_65 - VENTILATION AND AIR CONDITIONING SYSTEMS															
Ss_65_40_33	General space ventilation systems														
Ss_65_40_80	Smoke extract and control systems														
Ss_65_40_94	Vehicular space ventilation systems														
Ss_65_80_05	Central air conditioning systems														
Ss_65_80_45	Local air conditioning systems														
Ss_70 - ELECTRICAL SYSTEMS															
Ss_70_10_80	Solar power generation systems														
Ss_70_30_45	Low-voltage systems														
Ss_70_30_80	Small power systems														
Ss_70_80_25	External lighting systems														
Ss_70_80_33	General space lighting systems														
Ss_75 - COMMUNICATIONS, SECURITY, SAFETY, CONTROL AND PROTECTION															
Ss_75_10_21	Data distribution and telecommunications systems														
Ss_75_10_46	Listening systems														
Ss_75_10_68	Public communications systems														
Ss_75_40_02	Access control systems														
Ss_75_40_53	Monitoring systems														
Ss_75_40_75	Security detection alarm systems														
Ss_75_50_11	Call and alarm systems														
Ss_75_50_28	Detection and alarm systems														
Ss_75_70_54	Metering, monitoring and management systems														

RIBA Plan of Work 2020

The RIBA Plan of Work organises the process of briefing, designing, delivering, maintaining, operating and using a building into eight stages. It is a framework for all disciplines on construction projects and should be used solely as guidance for the preparation of detailed professional services and building contracts.

0	1	2	3	4	5	6	7
Strategic Definition	Preparation and Briefing	Concept Design	Spatial Coordination	Technical Design	Manufacturing and Construction	Handover	Use

Projects span from Stage 1 to Stage 6; the outcome of Stage 0 may be the decision to initiate a project and Stage 7 covers the ongoing use of the building.

Stage Boundaries:

Stages 0-4 will generally be undertaken one after the other.

Stages 4 and 5 will overlap in the **Project Programme** for most projects.

Stage 5 commences when the contractor takes possession of the site and finishes at **Practical Completion**.

Stage 6 starts with the handover of the building to the client immediately after **Practical Completion** and finishes at the end of the **Defects Liability Period**.

Stage 7 starts concurrently with Stage 6 and lasts for the life of the building.

Planning Note:

Planning Applications are generally submitted at the end of Stage 3 and should only be submitted earlier when the threshold of information required has been met. If a **Planning Application** is made during Stage 3, a mid-stage gateway should be determined and it should be clear to the project team which tasks and deliverables will be required.
See *Overview* guidance.

Procurement:

The RIBA Plan of Work is procurement neutral – See *Overview* guidance for a detailed description of how each stage might be adjusted to accommodate the requirements of the **Procurement Strategy.**

ER Employer's Requirements

CP Contractor's Proposals

	0	1	2	3	4	5	6	7
Stage Outcome at the end of the stage	The best means of achieving the **Client Requirements** confirmed If the outcome determines that a building is the best means of achieving the **Client Requirements**, the client proceeds to Stage 1	**Project Brief** approved by the client and confirmed that it can be accommodated on the site	**Architectural Concept** approved by the client and aligned to the **Project Brief** The brief remains "live" during Stage 2 and is derogated in response to the **Architectural Concept**	Architectural and engineering information **Spatially Coordinated**	All design information required to manufacture and construct the project completed Stage 4 will overlap with Stage 5 on most projects	Manufacturing, construction and **Commissioning** completed There is no design work in Stage 5 other than responding to **Site Queries**	Building handed over, **Aftercare** initiated and **Building Contract** concluded	Building used, operated and maintained efficiently Stage 7 starts concurrently with Stage 6 and lasts for the life of the building
Core Tasks during the stage **Project Strategies** might include: – **Conservation** (if applicable) – **Cost** – **Fire Safety** – **Health and Safety** – **Inclusive Design** – **Planning** – **Plan for Use** – **Procurement** – **Sustainability** See *RIBA Plan of Work 2020 Overview* for detailed guidance on **Project Strategies**	Prepare **Client Requirements** Develop **Business Case** for feasible options including review of **Project Risks** and **Project Budget** Ratify option that best delivers **Client Requirements** Review **Feedback** from previous projects Undertake **Site Appraisals** No design team required for Stages 0 and 1. Client advisers may be appointed to the client team to provide strategic advice and design thinking before Stage 2 commences.	Prepare **Project Brief** including **Project Outcomes** and **Sustainability Outcomes**, **Quality Aspirations** and **Spatial Requirements** Undertake **Feasibility Studies** Agree **Project Budget** Source **Site Information** including **Site Surveys** Prepare **Project Programme** Prepare **Project Execution Plan**	Prepare **Architectural Concept** incorporating **Strategic Engineering** requirements and aligned to **Cost Plan**, **Project Strategies** and **Outline Specification** Agree **Project Brief Derogations** Undertake **Design Reviews** with client and **Project Stakeholders** Prepare stage **Design Programme**	Undertake **Design Studies**, **Engineering Analysis** and **Cost Exercises** to test **Architectural Concept** resulting in **Spatially Coordinated** design aligned to updated **Cost Plan**, **Project Strategies** and **Outline Specification** Initiate **Change Control Procedures** Prepare stage **Design Programme**	Develop architectural and engineering technical design Prepare and coordinate design team **Building Systems** information Prepare and integrate specialist subcontractor **Building Systems** information Prepare stage **Design Programme** Specialist subcontractor designs are prepared and reviewed during Stage 4	Finalise **Site Logistics** Manufacture **Building Systems** and construct building Monitor progress against **Construction Programme** Inspect **Construction Quality** Resolve **Site Queries** as required Undertake **Commissioning** of building Prepare **Building Manual** Building handover tasks bridge Stages 5 and 6 as set out in the **Plan for Use Strategy**	Hand over building in line with **Plan for Use Strategy** Undertake review of **Project Performance** Undertake seasonal **Commissioning** Rectify defects Complete initial **Aftercare** tasks including light touch **Post Occupancy Evaluation**	Implement **Facilities Management** and **Asset Management** Undertake **Post Occupancy Evaluation** of building performance in use Verify **Project Outcomes** including **Sustainability Outcomes** Adaptation of a building (at the end of its useful life) triggers a new Stage 0
Core Statutory Processes during the stage: Planning Building Regulations Health and Safety (CDM)	Strategic appraisal of **Planning** considerations	Source pre-application **Planning Advice** Initiate collation of health and safety **Pre-construction Information**	Obtain pre-application **Planning Advice** Agree route to **Building Regulations** compliance Option: submit outline **Planning Application**	Review design against **Building Regulations** Prepare and submit **Planning Application** See ***Planning Note*** for guidance on submitting a **Planning Application** earlier than at end of Stage 3	Submit **Building Regulations Application** Discharge pre-commencement **Planning Conditions** Prepare **Construction Phase Plan** Submit form F10 to HSE if applicable	Carry out **Construction Phase Plan** Comply with **Planning Conditions** related to construction	Comply with **Planning Conditions** as required	Comply with **Planning Conditions** as required
Procurement Route Traditional	Appoint client team	Appoint design team	Appoint contractor		Tender / Appoint contractor			Appoint **Facilities Management** and **Asset Management** teams, and strategic advisers as needed
Design & Build 1 Stage					ER / CP / Appoint contractor			
Design & Build 2 Stage			ER	Pre-contract services agreement	CP / Appoint contractor			
Management Contract Construction Management			Appoint contractor					
Contractor-led			ER	Preferred bidder	CP / Appoint contractor			
Information Exchanges at the end of the stage	**Client Requirements** **Business Case**	**Project Brief** **Feasibility Studies** **Site Information** **Project Budget** **Project Programme** **Procurement Strategy** **Responsibility Matrix** **Information Requirements**	**Project Brief Derogations** Signed off **Stage Report** **Project Strategies** **Outline Specification** **Cost Plan**	Signed off **Stage Report** **Project Strategies** Updated **Outline Specification** Updated **Cost Plan** **Planning Application**	**Manufacturing Information** **Construction Information** **Final Specifications** Residual **Project Strategies** **Building Regulations Application**	**Building Manual** including **Health and Safety File** and **Fire Safety Information** **Practical Completion** certificate including **Defects List** **Asset Information** If **Verified Construction Information** is required, verification tasks must be defined	**Feedback** on **Project Performance** **Final Certificate** **Feedback** from light touch **Post Occupancy Evaluation**	**Feedback** from **Post Occupancy Evaluation** Updated **Building Manual** including **Health and Safety File** and **Fire Safety Information** as necessary

Core RIBA Plan of Work terms are defined in the *RIBA Plan of Work 2020 Overview* glossary and set in **Bold Type**.

Further guidance and detailed stage descriptions are included in the *RIBA Plan of Work 2020 Overview*.

RIBA Architecture.com

Change Control Procedures

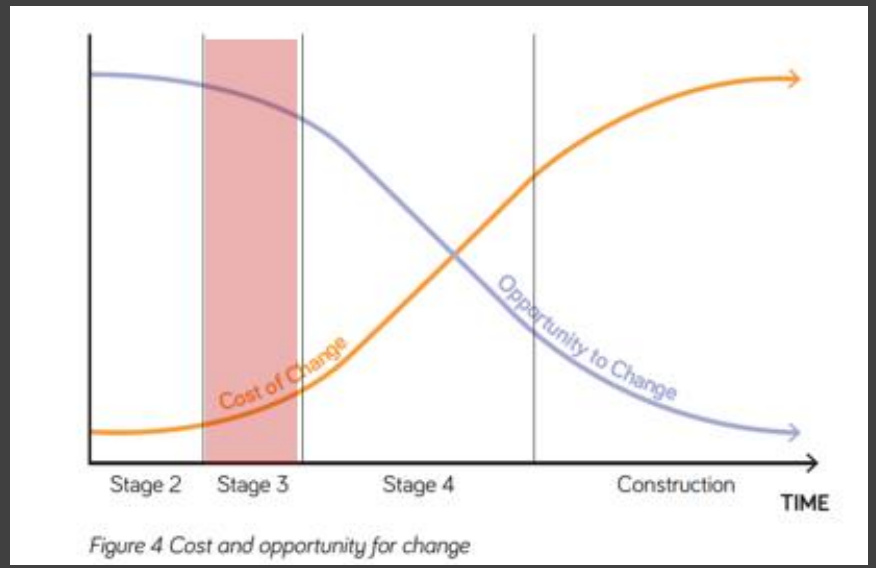


Figure 4 Cost and opportunity for change

Term/task	**Definition** (guidance is included in grey boxes)
Change Control Procedures	Procedures for controlling changes to the design and construction following the sign-off of the Stage 2 **Concept Design** and the final **Project Brief**.

During Stage 3, the design continues to be developed with **Design Studies**, **Engineering Analysis** and **Project Strategies**. This work is termed 'design development' and might involve tweaks to the **Architectural Concept**. Functional changes – for example, relocating a space or changing its size – are not design development and should be dealt with under the **Change Control Procedures**.

The RIBA Plan of Work recommends that **Change Control Procedures** formally commence at the start of Stage 3. This allows any proposed changes to the **Architectural Concept** to be properly considered before they are implemented, noting that changes can impact different members of the design team in different ways.

It should also be noted that any substantive changes to the **Project Brief** during Stage 2 also require client instructions. Examples of substantive changes would be increasing the area of office space required by 20% or adding a new lecture theatre to the **Project Brief**. The impact of these changes, including the need for additional fees or an extension to the Stage 2 **Design Programme**, will depend on when they are instructed and how significantly they impact on the design work undertaken to date.

As the project progresses into Stage 4 and towards construction at Stage 5, the cost of change increases as more design information needs to be updated and, ultimately, there is a point where change impacts on work that is under way on site, as figure 4 illustrates.

Case Study – SIA

SCOPE OF SERVICE MATRIX

BASIC SERVICE

ROLE	STAGES							
	Pre-Design	**Concept Design**	**Schematic Design**	**Design Development**	**Documentation**	**Construction**	**Completion**	**Post Completion**
Designer	▪ Assist the Client in establishing the Design Brief ▪ Site investigation to ascertain site conditions	▪ Provide initial design to meet the Design Brief in general ▪ Assist the Client to refine the Design Brief	▪ Develop the initial design to sufficient level of detail required for Development Control submissions. ▪ Prepare Outline Specifications to determine preferred materials, quality and construction method.	▪ Develop the Schematic Design to sufficient level of detail required for Building Plan submissions.	▪ Prepare architectural Tender Drawings and Specifications to sufficient level of detail to enable pricing appropriate to the selected procurement method.	▪ Prepare architectural Construction Drawings ▪ Attend to construction issues relevant to the design ▪ Check Contractor's submissions against the design intent ▪ Inspect site to check the works against the design intent	▪ Inspect site to check the completed works against the design intent	
Qualified Person	▪ Pre-design research on regulatory requirements ▪ Obtain previously approved drawings, if necessary ▪ Consult authorities on general and/or site-specific regulatory requirements, if necessary	▪ Ensure that the design complies with regulatory requirements ▪ Consult authorities on specific regulatory requirements, if necessary ▪ Obtain land / building owner's consent, if necessary	▪ Ensure that the design complies with regulatory requirements ▪ Prepare submission plans and submit to URA for Written Permission ▪ Prepare submission plans and submit to other authorities for DC Clearances[1] ▪ Application for waivers[2] ▪ Amendment submissions[3]	▪ Ensure that the design complies with regulatory requirements ▪ Prepare submission plans and submit to authorities for BP/DP Clearances[1] ▪ Prepare submission plans and submit to BCA for BP Approval	▪ Advise on regulatory requirements to be included in the building contract.	▪ Ensure permits and clearances required prior to commencement are obtained ▪ Monitor Contractor's compliance with statutory requirements ▪ Inspect site to check that the works are carried out in accordance with Approved Plans	▪ Submit architectural as-built drawings ▪ Arrange for required authority inspections ▪ Obtain clearances required for occupancy from relevant authorities, if necessary. ▪ Report to IRAS	▪ Obtain clearances required for statutory completion from relevant authorities
Contract Administrator	▪ Advise on appropriate procurement method(s)	▪ Advise on selection of form of building contract	▪ Provide input on contractual matters for Outline Specifications ▪ Identify items requiring early procurement	▪ Check Client's requirements for pricing / procurement exercise ▪ Pre-qualify suitable builders for tender exercise ▪ Formulate tender evaluation criteria	▪ Compile Tender Documents ▪ Conduct pricing / tender process ▪ Facilitate the award of building contract(s) ▪ Compile Contract Documents	▪ Administer the building contract, including issuing orders and certification in accordance with the building contract. ▪ Conduct site meetings ▪ Inspect site to check that the works are carried out in accordance with the building contract		▪ Address latent defects and minor outstanding works, if any ▪ Work with the QS to conclude the Final Account and building contract
Design Manager / Project Administrator	▪ Ascertain Client's budget / prepare Project Budget ▪ Ascertain project timeline / prepare the Project Programme ▪ Advise on consultants needed ▪ Establish communication protocols	▪ Track the design process ▪ Assist Client in appointment of consultant team ▪ Prepare Project Plans / Responsibility Matrices/ Execution Plans ▪ Assist the QS to develop Preliminary Cost Estimate ▪ Update the Project Programme	▪ Coordinate and manage communication among the project team and other relevant parties ▪ Track the design process ▪ Review QS's Cost Estimate against the Project Budget. ▪ Monitor progress against the Project Programme			▪ Monitor construction cost against the budget ▪ Monitor construction progress against the Project Programme	▪ Manage the handover process	

Abbreviations

BP	Building Plan	BCA	Building and Construction Authority	C&S	Civil & Structural Engineer	CAD	Computer Aided Drafting
DC	Development Control	IRAS	Inland Revenue Authority of Singapore	M&E	Mechanical & Electrical Engineer	BIM	Building Information Model
DP	Detailed Plan	URA	Urban Redevelopment Authority	QS	Quantity Surveyor	GFA	Gross Floor Area

[1] In the consultancy agreement, the Architect can list the submissions to authorities included in the scope. A Provisional Sum may be provided for those not included.
[2] In the consultancy agreement, the Architect can fill in rates for waiver applications.
[3] In the consultancy agreement, the Architect can fill in rates for amendment submissions.

These are normally included in the Architect's scope, although there may be instances where these are not necessary, in which case there is usually no reduction in fee.
The process includes identifying design changes defined under Additional Service.

SCOPE OF SERVICE MATRIX

ADDITIONAL SERVICE

ROLE	STAGES							
	Pre-Design	**Concept Design**	**Schematic Design**	**Design Development**	**Documentation**	**Construction**	**Completion**	**Post Completion**
Designer	▪ Conversion of drawings of existing building(s) to CAD/BIM ▪ Measured drawings of existing building(s) ▪ User / community engagement	▪ Design change[4] ▪ Artist's impression / Walk-through / Virtual Reality ▪ Review work by previous Designer	▪ Performance-based design ▪ Design change[4] ▪ Providing architectural content for Client's marketing purposes / public exhibition ▪ Basic Interior Design ▪ Signage Design ▪ Physical model		▪ Documentation resultant from design changes[4] ▪ Artwork for hoarding	▪ Revised and/or additional construction drawings resultant from design changes[4]	▪ As-Built BIM model	▪ Post-occupancy evaluation ▪ Building performance study and gap analysis ▪ Review tenancy layout by others ▪ Attending to other parties (e.g. purchasers, users) ▪ Witness of Fact (preparing material, statements and attendance to hearings)
Qualified Person	▪ Special or protracted negotiations with authorities ▪ Checking existing building(s) for compliance	▪ Outline Application to URA ▪ Consulting authorities not previously included in scope of service ▪ Review submissions by previous Qualified Person	▪ Re-computation of existing GFA ▪ Checking and endorsement of Client's marketing material ▪ Performance-based submissions ▪ Non-mandatory Green Mark Scheme – documentation for application, assessment & presentation to certification body[5] ▪ Application for house number ▪ Application for change of use ▪ Application for advertisement licence ▪ Application for operating licence			▪ Protraction[6] ▪ Certification under Housing Developers (Control and Licensing) Act	▪ Green Mark Certification – documentation for Verification and attendance to certification body ▪ Assist in strata and/or land sub-division ▪ Assist in vesting of land to the State	
Contract Administrator				▪ Input into drafting of particular conditions	▪ Conduct pricing / tender process for nominated sub-contract(s) ▪ Conduct pricing / tender process for Client's direct contract(s) ▪ Conduct pricing / tender process for early works contracts	▪ Protraction[6] ▪ Providing architectural staff resident on site ▪ Coordinating the work of Client's direct contractor(s) ▪ Administering contracts other than standard forms commonly used in Singapore ▪ Certification required under Client's sales and purchase agreement		
Design Manager / Project Administrator	▪ Managing user / community engagement	▪ Coordination of consultants in addition to C&S, M&E & QS. ▪ Coordination of and liaison with any other parties not previously included in scope of service. ▪ Administration of engagement of Site Staff or any other parties not previously included in scope of service.						

Abbreviations

BP	Building Plan	BCA	Building and Construction Authority	C&S	Civil & Structural Engineer	CAD	Computer Aided Drafting
DC	Development Control	IRAS	Inland Revenue Authority of Singapore	M&E	Mechanical & Electrical Engineer	BIM	Building Information Model
DP	Detailed Plan	URA	Urban Redevelopment Authority	QS	Quantity Surveyor	GFA	Gross Floor Area

[4] Design change means any change:
- resultant from a change to the Design Brief;
- requested by the Client subsequent to the Client's expressed or implied acceptance of the design;
- necessitated by new authority requirements; or
- necessitated by site conditions / construction method

[5] Computer simulation , if required , is usually done by a specialist

[6] In the consultancy agreement, the Architect can fill in rates for protraction

Design Change Management

ACES-SIA General Consensus

CX Focus workgroup discussion – Design Change Management

2

Effective **'Design Change and Management Protocol'** is essential to support the process and workflow. Project Owner and Client involvement of decision making is essential.

Having this approach, we will be able to support the CX objective of

"It allows the project team, which includes the QPs, to collaborate and review their designs in the model together, detect possible major conflicts before construction, and produce a coordinated BIM model for submission and regulatory approval. It changes the current practice of QPs dealing separately with multiple regulatory agencies, and producing different versions of building plans thereafter".

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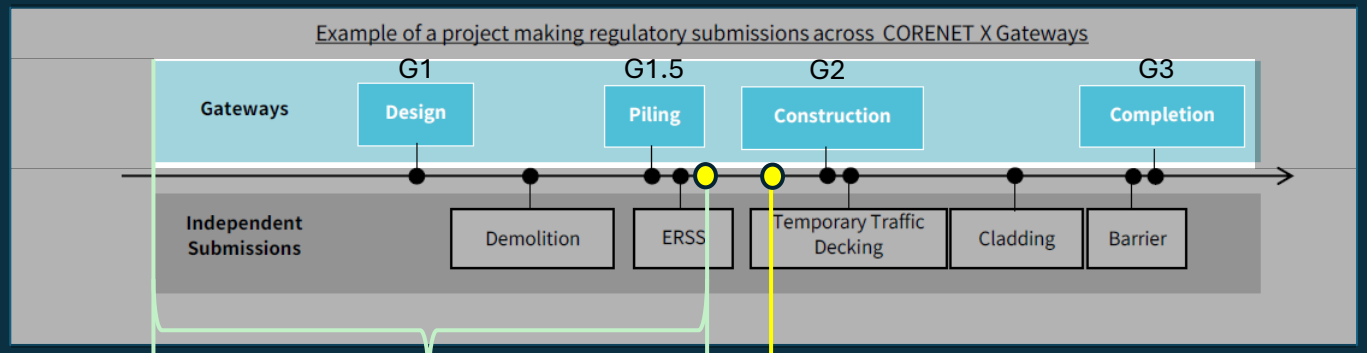

Utility incoming service / lead in pipe coordination and confirmation

Preliminary design of MEP services

MEP Design Coordination with Arch, C&S

MEP Independent Agency Submission

Implementation of "Design Change Management and Control"

Any change

Design Plan (Arch) sign off for Design Team preparing Construction Gateway & Independent Submissions

...

The Engineering submission will base on the Frozen Plan

Design Plan (Arch) sign off for Design Team preparing Gateway & Independent (Amendment) Submissions

"One single source of truth"

Independent Agency Submissions

Agency	Summary of Independent Agency Submissions	Common Gateway Key Words
BCA	• Structural design of localized works with design calculations of ancillary structures e.g. cladding, barrier • Structural design of ancillary works and component such as demolition, temporary ERSS, barriers & cladding, temporary traffic decking • Building design details of specialized works such as • Details of lift equipment and escalators • Constructability Implementation Plan • Environmental Sustainability Detailed Requirements • Outdoor Advertising Sign or Signboard License	• Buildability • Connectivity • Equipment • Façade • Environmental Sustainability • Household / Storey Shelter • Infra & Utilities (Internal) • Lightning Protection • Signage • Structural Design
LTA	Railway protection/Road structure protection details for engineering work/ restricted activities apart from aspects cleared in Piling Gateway / Construction Gateway: • Plan for engineering works • Engineering evaluation report • Instrumentation proposal • Method statement of work • Emergency procedure	• Impact Studies • Rail Protection • Road Structure Protection • Site Layout
NEA	• Temporary Sanitary Facilities at Construction site • Detailed Plan on Pollution Control Equipment, Pollution Control Study (PCS) • Noise Impact Assessment (NIA)	• Noise Control • Pollution Control • Vehicular Parking
NParks	• Planting/Landscaping scheme of planting areas within development, including open air parking areas at street level, and of green verges along roadside (i.e. number and species of trees and plants to be planted) • Details of new tree planting and reinstatement works for green verge affected by entrance culvert	• Greenery
PUB	• Application for specified activities near Water and Sewer pipes • Earth Control Measures (ECM) • Temporary works affecting drainage/within drainage reserve (e.g. drain diversion, soil investigation works) • Notification and completion of minor sewer/sanitary works • Notification and CSC of Water Service Installation works • Notification and CSC of Water Service Installation Works involves pumping equipment or water tank (site plans, water reticulation schematic/layout drawing of WSI design works, water requirements, SP Water Utilities Account number) Separate submission may be made for Rainwater Collection System in developments for non-potable water use	• Infra & Utilities (Internal) • Water Supply

Agency	Summary of Independent Agency Submissions	Common Gateway Key Words
SCDF	**Fire Protection (FP) and Mechanical Ventilation (MV) Plans** • Detailed layout and floor plan showing Fire Protection and Mechanical Ventilation system of development • Automatic Fire Alarm System • Automatic Fire Extinguishing System • Emergency Voice Communication System • Smoke Control System • Schematic diagram for the proposed system • Calculations and reports (where applicable)	• Equipment • Fire Compartmentation • Fire Fighting • Materials • Ventilation
URA	• Painting (for conserved buildings) • Signage (for conserved buildings)	• Conservation

Agency	Summary of Independent Agency Submissions	Common Gateway Key Words
SLA + URA	**Strata / Land Subdivision and/or Amalgamation** • As-built plans and/or 3D cadastre model. More details will be released in future regarding the latter.	-

ACES-SIA General Consensus

CX Focus workgroup discussion – Support & Training

3

Support and Training shall be identified and provided to the firm for onboarding the upfront, more detailed design workflow requirement and design management skill set.

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Best Practice – Information Exchange Required from Preliminary MEP Design

MEP Focus workgroup discussion – Preliminary MEP Design Scope

DESIGN GATEWAY (DG)

All incoming utilities & services

- Incoming power lead-in pipes and sub-station location
- Incoming telecommunication lead-in pipes and MDF room location
- Incoming PUB Water & Newater pipes, bulk meter location and distribution pipes up to entry points to building
- Public sewer connection points and internal underground sanitary drainage system
- Incoming town gas pipes up to entry points to the building

Should the underground services coordination within the site boundary be done now?

- Hydrant pipes wrt fire engine accessway/hardstand
- Connectivity between building for multi-block developments
- Coordination with internal stormwater drains
- Site and building platform levels
- Penetrations through retaining walls
- Basement carpark exhaust & fresh air locations, and kitchen exhaust discharge.

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MEP Focus workgroup discussion – Preliminary MEP Design Scope

CONSTRUCTION GATEWAY (CG)

Electrical Power Distribution System

- All major plant rooms including SPPG sub-station, HT/LV switchrooms, transformer rooms
- Electrical risers
- Horizontal main distributions between risers

SPPG is not part of Corenet X – approval of sub-station before CG submission?

Telecommunication/Data Distribution System

- All major plant rooms including MDF/IDF/TER
- Telecommunications/Data risers
- Horizontal main distributions between risers

MEP Focus workgroup discussion – Preliminary MEP Design Scope

CONSTRUCTION GATEWAY (CG)

Water/Newater Distribution System

- All major plant rooms including water tanks (RC/Panel) and pump rooms, hot water plant
- Water pipe shafts and water meter closets
- Horizontal main distributions between risers and major point of uses such as swimming pool
- PUB only requires schematic piping submission.
- Will PUB review the water tank and pump spatial and security provision during CG?

Sanitary Drainage System

- All major plant rooms including ejector rooms, sump pumps, grease traps, rainwater collection system, effluent treatment plant
- Pipe shafts, vent pipe discharge points
- Horizontal main distributions between risers and major points of discharge such as kitchens
- "Wet over dry areas" issues, double slab containments. Will these be resolved with PUB during CG?

MEP Focus workgroup discussion – Preliminary MEP Design Scope

CONSTRUCTION GATEWAY (CG)

Town Gas Distribution System

- Gas pipe shafts and gas meter closets
- Horizontal main distributions between risers and major point of uses
- Venting points for pipe shafts and pipe enclosures
- Prohibited area for gas pipe routing

PowerGas/CityEnergy is not part of Corenet X – consolidation of comments?

Lift System

- Quantity of lifts
- Lift shafts sizes, overrun and lift pits
- Lift motor room or motor-roomless

MEP Focus workgroup discussion – Preliminary MEP Design Scope

CONSTRUCTION GATEWAY (CG)

Fire Protection System

Pre-Requisite: SCDF BP by Architect to be approved under CG

- Mode of fire protection – SPKLR/FA/Performance-based Requirements

- All major plant rooms including water tanks and pump rooms for sprinkler, wet risers, hosereel and pumped hydrants
- Pipe shafts for main sprinkler pipe, hosereel pipe, wet/dry riser landing valves, sprinkler control valve closets, breeching inlets
- Horizontal main distributions pipes
- FCC room location for MAP, EVC head-ends equipment, lift supervisory panels

MEP Focus workgroup discussion – Preliminary MEP Design Scope

CONSTRUCTION GATEWAY (CG)

ACMV System

Pre-Requisite: SCDF BP by Architect & FEDB to be approved under CG

- Mode of ventilation – NV/MV/AC/Performance-based Requirements

Pre-Requisite: GreenMark requirements

- All major plant rooms and outdoor spaces including chilled water plant, cooling towers, outdoor condensing units, AHU, MV fan, kitchen exhaust fans, smoke exhaust, carpark ventilation, etc
- Pipe shafts for chilled & condenser water pipes, condensate drains
- Duct shafts for staircase pressurization/MV, SFL/FFL, toilet exhaust, fresh air, kitchen exhaust, smoke exhaust, carpark ventilation, etc
- Horizontal main distributions pipes and duct spaces; DFMA modules as block out elements?
- Fresh air intake and exhaust points
- Kitchen exhaust points, cooling tower distancing, noise to boundary – NEA(???)

MEP Focus workgroup discussion – Preliminary MEP Design Scope

CONCLUSIONS

- Independent Submissions are required to allow for the CG approval to be obtained in shorter time.
- With Independent Submissions, it does not mean that there is no need for MEP design works up-front during DG and CG
- Project teams need to re-visit our current design workflows practices.
- Though only spatial provisions are required up-front for the MEP systems, the extent of the MEP design effort will depend on complexity and types of the project, which needs to be deliberated among the team members.
- New effort by ACES on M&E Engineering Digital Design Automation Platform (DDAP) may assist firms to churn out preliminary MEP design to fullfil the CG requirements.

End