

Information for:

Potential Consultancy Services Building Information Modeling For: Mixed-use High Rise

Understanding the Benefits of BIM for Vietnam



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High rise Projects using BIM Methodology & Execution

Why Use a 3rd Party BIM Consultant?

Today many projects in ASIA (Singapore, Thailand and Vietnam) are fast tracked and many designers claim that Project design in all main disciplines Architectural, Structural and MEPF, <u>are fully coordinated</u> in most cases in Vietnam this is rarely the case as designers working in a 2D design environment usually **do not adopt a collaborative approach** and each of the consultants are intent on finishing the design in a desired (shortest) time period scenario, which can be detrimental to the overall coordination. A lot of responsibility for overall coordination is passed to the Contractor to resolve in Shop Drawings which normally results in extended time and extra works. The cost of this is always absorbed by the Client /Investor.

A 3rd Party BIM Consultant engaged by the Client Shall Construct the Architectural, Structural and MEPF Models from the Designers 2D Documentation in 3D, THEREBY TESTING THE DESIGNS, HIGHLIGHTING AND RESOLVING ISSUES WITH DESIGNERS DELIVERABLES, AND AVOIDING CONTRACTORS VARIATIONS DURING CONSTRUCTION. The BIM consultant will advise the Client and the PMC on all matters arising in the Constructed Model which can be used for better Value engineering to further reduce Capital Expenditure and the overall Project can be constructed using the 3D Model to fast track the construction Stage. All Issues Clashes and design errors are corrected by the Design Consultant at their own Cost not by the client / Investor, this in itself is a major positive for investors at the start of the Project. After models are completed, coordinated, clash-free, the Contractors, can input directly to the 3rd Party design Consultants Models to produce "Shop Drawings" at a fraction of the time for the normal production period, again reducing time and Cost. These early corrections and proving of the designs to produce "issue free" models ensures a fast track construction Period, again reducing time and cost. During testing and Commissioning the Models are updated by the contractors under the supervision of the 3rd Party Consultants to complete the models and deliverables derived from the models as "As built". The models can then be used for the Operations and Maintenance of the overall Completed Facility. Please remember BIM is not a cost addition to the design fees, BIM is insurance & assurance for Investors and brings about a reduction in overall investment for the Investor, therefore, BIM actually Pays for itself many times over.

Engcorp Ltd Thailand & Vietnam

With 10 Years of Experience in Vietnam & Thailand as Engineering Design Consultants on Local and Internationally designed Projects, and as Project and Construction Managers, we have a unique understanding of the Construction Industry in both countries, including the strengths and weaknesses of designers and Contractors operating throughout these Countries. Where international standards are used for Projects by external consultants there can be issues with statutory compliance based on Government regulations, decrees, and circulars that can make Projects more complicated than usual especially with regards to Fire Systems and engineering design (TIS & TCVN) for buildings whereby the local Fire Standards are the only one accepted in Most cases. Our BIM teams in Vietnam and Philippines are very experienced in Local and International Standards, which gives us an edge over other BIM Companies as we approach each BIM Project as design Consultants, not BIM Modelers, this is always very positive for the client team as this collaboration can be developed at any level during the Project and affords a level of comfort for the Client team as they can see the benefits of engaging a BIM consulting team who are also Construction designers, this is most beneficial in the areas of Coordination and Clash detection and resolution.

We have gained many years of experience as Design Consultants and BIM Consultants on Projects in Australia, Qatar, Dubai, Thailand, UK, HK and Vietnam.

What would be Our Proposed Scope of Works?

Our proposal would outline our understanding of the project requirements in terms of Scope of work for Architectural, Structural and MEPF documentation, Revit modelling, **Design Clash Resolution and Coordination of services.**

Our fee is Proposed and estimated using Revit through the DD and CD work stages, Base Build, in producing these drawings, modelling and carrying out design coordination and design resolution suggestions,

final agreement will be subject to further detailed discussions to finalize scope, the detailed program and terms and conditions of contract. (sub consultancy agreement).

We hope that a BIM proposal is of interest and we believe as experienced locally based international Design Consultants, that we can add the depth f knowledge required to execute a Top-Quality BIM Project in Vietnam.

BIM Deliverables

As Models (Architectural, Structural and MEPF), are constructed in Revit from the Design Consultants Documentation Provided, much emphasis must be Placed on the time and resources required for the complete coordination of all Disciplines.

As Main consultants in many cases work on the same Project remotely from each other in different countries, coordination inside the 2D design can become an issue as the coordination problems are revealed gradually during the Model Construction Progress. For example - In Vietnam this usually occurs in the MEPF Systems Design – Overall Lead of the Design is sometimes loosely established and if that is the Architect, they rarely demand for Sections through services in services congested areas, corridors or Plantrooms, many MEPF design are delivered completely IN PLAN VIEW only with limited or NO SECTIONS available, which means no designer has a clear understanding on the "Height of services" not the Impact that's has had on the Architectural and Structural design, until the BIM consultants have created the necessary sections and levels in the Model. It is imperative that this is explored, discussed and fully understood by all parties, early on to mitigate any delays in BIM deliverables.

Engcorp BIM teams can work with Design Teams to help resolve this if/when known hopefully at the earliest stage of the BIM Scope commencement. – Example - Architects and Interior Designers have established client requirements on ceiling heights and have developed elaborate Ceiling design and RCP,s – when Engineering services (designed on Plan) are modeled into these Spaces with the given height of ceiling/Ceiling Void, it is usually found that Services can't be coordinated within the given space thereby lowering ceilings.

This is extremely important as this will affect the Program of deliverables for:

WIP Models Delivery /Construction Documentation - As required and detailed in the Scope of Works

Clash detection analysis Reports

Spatial Validation reports

Structural & MEP Space Optimization Details

Issuance of 2D Architectural Construction Drawings (LOD300)

Issuance of 2D Structural Construction Drawings (LOD300)

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Issuance of 2D Mechanical Construction Drawings (LOD300) Issuance of 2D Structural Steel Drawings (LOD400) Issuance of 3D Fully Dimensioned Model for Architecture Issuance of 3D Fully Dimensioned Model for Structure Issuance of 3D Fully Dimensioned Model for MEPF Issuance of 3D Fully Dimensioned Federated Model of Architecture/Structure& MEPF full coordinated



Structural



M&E





Architectural

Federated Model

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BIM Consultant Services

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Why Use Building Information Modelling?



BENEFITS OF BUILDING INFORMATION MODELING FROM 3 RD PARTY BIM CONSUTANT:

- CHECKING & TESTING DESIGNS ARE CORRECT, CLASH FREE & ALL DISCIPLINES FULLY COORDINATED – (Architecture, Structure, M&E)
- SAVING DESIGN, CONSTRUCTION & INSTALLATION TIME (Fast Track Construction)
- REMOVING EXTRA WORK OR RE-WORK (EXPENSIVE VARIATIONS) DURING
 CONSTRUCTION
- VISUALISING THE PROJECT IN 3D BEFORE THE INSTALLATION COMMENCES
- COORDINATING THE FULL 3D MODEL WITH THE CONSTRUCTION MASTER PROGRAM (4D BIM)
- DELIVERING ACCURATE QUANTIFIED TAKE-OFF OF ALL MATERIALS OF EACH DISCIPLINE ON THE PROJECT FROM THE 3D MODELS (5D BIM) THEREBY PROTECTING AND/OR REDUCING THE CONSTRUCTION BUDGET
- CLIENT & PMC WITH COMLETE 3D VISUALIZATION OF A FULLY COORDINATED CONSTRUCTED PROJECT MODEL CAN EASILY CONTROLTHE PROJECT & CONTRACTOR ON A GURANTED TIMESCALE AND CONSTRUCTION BUGET, MAKING A GUARANTEED MAXIMUM PRICE CONTRACT (GMP) FROM CONTRACTORS POSSIBLE REDUCING INVESTORS FINANCIAL RISK.

Clash Detection – Saving time and Cost on Variations during Construction:

This is a function of BIM where models from separate disciplines (architectural, structural and MEP) are aligned against each other and are checked for any physical or clearance clashes. Once clashes are found designers can correct the problems and iterate the models until they are clash free. By carrying out this activity virtually, a significant amount of time and money that would otherwise be wasted through rework or delay is saved. This would be nearly impossible to achieve with traditional 2D CAD technologies, where even if drawings are overlaid on each other, they do not always make it easier for the user to identify where the clash would be in a 3D space. Also, there is no method to automate clash checking.

Another example relates to visualization of coordinated/synchronized models. Models from separate disciplines are synchronized and visualized from the early conceptual design stage.

This allows clients and, in particular, end users to provide their input, and designers to better understand the requirements from the client. This ensures a much better requirement and design intent flow down through the various stages of the project. This function contributes directly to waste minimization and value generation principles of Lean construction.

However, it must be understood that for this to happen, early involvement of stakeholders in the project is required.





As the 3 D Model is constructed from the 2D Design documentation it is impossible to see in CAD Coordination and design errors - This is picked up automatically by the BIM Software (NAVIS) and identified and Located in the Project to be cleared by the designer – This is done long before construction as these clashed would cause difficulty or Costly extra works Later.







BIM for Collaborative Planning - Linking the Models to the Construction Program:

this can be exemplified by the use of the BIM model during design production. Collaborative planning is one of the major contributions functions of Lean construction and is popular among the Lean tools on construction projects in the UK & Australia, it is becoming increasingly difficult for stakeholders to visualize the task at hand and also the sequence of the process, particularly on a complex project where there are complicated services being installed. One of the main features of collaborative planning is to gain a deeper understanding of the planned activities in advance. Also, one of the related activities is 'first run studies' where users try different work methods and sequences to identify how a construction task can be best performed and optimized.

By using BIM tools such as 4D planning, where a 3D model is linked to the project plan and simulated to demonstrate the activities for a selected period, the team visually gains a much deeper, mutual understanding as compared to the use of 2D drawings during planning meetings. If used appropriately, 4D scheduling can also serve the function of a virtual 'first run study'.



BIM- Material Take off from Models can be used for the Cost Plan:

analysis models for cost management is an example of this. Such a model can carry out useful, value-adding calculations that were too cumbersome to do using drawings. However, for deriving full benefit from such calculations, it may be necessary to change the design process so that the possibility of design improvements through rapid iteration can be realized in design practice.



BIM reducing Costs:

- 1. Reduction of waste by getting the quality right first time (through a better designed project, (viewed in Plans sections and elevations in 3D) reducing the project variability, ie reduction of the need for changes during the later stages of design).
- 2. Improved flow and reduced production uncertainty.
- 3. Reduction in overall construction and Installation time.

As these are the core functions construction, it can be deduced that if exploited properly, these initiatives have the right ingredients for a successful project delivery.

While it has been observed that there are significant synergies between BIM and Construction, it is also important to identify how it transpires into the characteristics or functions of a construction project.



Slicing the Building into sections for review of design, discussion and correcting issues

BIM - During Construction Phase

Construction Management of the entire project from the BIM Model. Utilizing he BIM Model for:

- Proving the design is correct and it is what the Investors and stakeholders expect the project to be.
- Identifying any design errors, omissions and coordination problems Clash detection between all disciplines (Arch/struc/MEPF) and rectifying same to ensure zero problems during Construction Phase.
- Viewing the model-offering complete 3d visualization of the Project externally and spaces internally including for spatial Planning, ease of installation, Construction and Maintenance (all disciplines-Architectural, Structural and Mechanical and Electrical Systems).
- Detailed Material Schedules Costed to reveal the correct Budget for the Project (5D).
- Controlling Progress at Site complete visualization of the Project (Model) from the meeting room.
- Attaching the Model to the Construction Program (4D) to visualize Planned and Actual Progress, affording detailed reporting and cost evaluation for Payments to Contractors.



Coordination of MEPF Architectural and Structural – Architectural Model is Shown as Transparent to highlight, MEPF

BIM IN VIETNAM

In Vietnam we offer our clients a unique advantage to project and construction Management as follows-

Stage 1. Transforming the 2D Design into 3D Model

Engcorp takes control of Client Standard 2 D Design of Architecture, Structure, and Mechanical and Electrical systems and produces a 3D BIM MODEL of the project. From this we are able to resolve any design issues and coordination problems by constructing your project system by system. We build it before the construction Phases and solve all issues which gives the client Huge savings on Investment capital as problems that would have surfaced down line resulting in Contractor variations and add cost and design changes, are solved in the model. THIS ENABLES FAST TRACK/ PROBLEM FREE CONSTRUCTION. - THEN comes the 4D planning and scheduling.





Convoluted 2D CAD Drawing showing MVAC

Easy to view 3D Version - can walk through the systems

Stage 2. 5D BIM. Detailed Cost of the Project.

One of the most important parts of any Project – THE COST. Needless to say, all Investors and stakeholders need to know the Project Cost from the Outset. Quantity Surveyors can offer basic Budget Costs for Projects based on Rates Per Meter Squared (M2). This is updated during each design Phase whereby actual quantities of materials are measured and quantified again against market rates for Plant and materials. BIM Tools have the capability of Automatically Quantifying all Materials in the Project and on the Model. This Information is coupled with a QS Software whereby quantities are checked and Individual Costs added and a BOQ produced which is the main basis of the Cost Report & Project Budget.

Material Take Off (MTO) Quantities

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	01010		A.10.10.1.11	Wall Foundation			\$3.907 ft	3.000 ft			
EP-UI Kool Construction	8.10.20		A.10.10.1.12	Wall Foundation			15.613 #	3.000 ft			_

Material Take off From BIM Tools can be compared to the cost consultant take off – BIM is always more accurate - saving cost on Materials

Stage 3 4D Planning and Scheduling

scheduling is one example of synergy where BIM can be used to achieve lean effects, either to support traditional planning methodology or to complement the Last Planner[™] System. This blog post is meant to give an introduction to 4D scheduling and how some projects at Skanska achieve lean effects from using 4D in projects.

4D SCHEDULING- 4D means adding the dimension of time to the 3D model by linking plan activities to corresponding BIM objects (figure 1). The schedule can be created directly in the 4D software or be imported (e.g. MS Project,



It's worth noting that the BIM model itself, just like 2D drawings, essentially is a representation of the finished design and therefore a fixed point in time (the completed project). 4D software (e.g. Navisworks, Synchro, VICO) however, provide an interactive timeline that allows us to represent the construction project at any point in time. In other words, you can build the entire building virtually before actual construction starts to find the optimal schedule.

4D ensures a better schedule in terms of constructability and workflow, where project participants and clients better communicate and collaborate. Instead of traditional sub-optimal information flow by verbally explaining current state and future work sequences, 4D enables projects to do this visually. This is especially beneficial in very complex projects Instead of drawings and Gantt charts, with 4D we can now bring the schedule to site and present it in a much more understandable way than ever before. Furthermore, by equipping crews with 4D software on mobile devices or stationary BIM units, they can mark completion statuses of objects or the model spaces themselves, so-called KanBIM1 to visualize workflow, which is especially useful in location based planning.

Not only objects of the construction itself can be represented in 4D, but also elements such as site objects and material deliveries. Beyond 4D, other dimensions to include are project costs (5D), operational and maintenance cost (6D) and health and safety factors (7D), although these terms have not yet fully reached consensus within the industry.

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For years we have known that using BIM in planning sessions can contribute to achieving better plan reliability, specifically by ensuring quality regarding the 4 quality criteria for assignments:

CONCLUSION

More and more construction projects are benefitting from BIM 3D & 4D scheduling, and experience that it ensures higher plan quality and better communication of the schedule between project stakeholders and Construction crews.

This system is ideal for The Vietnam Construction industry as many of the major contractors are now experienced in BIM and can use it to their advantage, Installation and Shop Drawings are taken directly from the coordinated Model and many months are saved on Construction Cost as shop drawings are easily produced from the Contractor. The PM CM and BIM Execution Managers monitor and control construction sequencing, Cost, QA/QC and safety from the model to the actual Construction Site & activities all activities are now FAST TRACKED.

it's now time that the client / investor /Stakeholders take advantage of the benefits of BIM on the design and Construction stages, ensuring the best design and shortest construction period with guaranteed cost savings and overall piece of mind.

TYPICAL BIM Scope of Work Base build Models for: HIGH RISE MIXED USE BUILDINGS

BIM LOD300 FOR ARCHITECTURAL & STRUCTURAL AND LOD200/300 FOR MEP(BASED ON AREAS/SCOPES BELOW)

(BASED ON INFORMATION FROM CONSTRUCTION DRAWINGS FROM DESIGNERS)

Develop further Architectural Revit Models from LOD200 to LOD300

Develop further Structural Revit Models from LOD200 to LOD300

Incorporation of 2D MEP Construction Drawings into model, for the following areas:-

Clash detection analysis

Issuance of 2D Architectural Construction Drawings (LOD300) + 3D Model in Revit

Issuance of 2D Structural Construction Drawings (LOD300) + 3D Model in Revit

Issuance of 2D MEP Construction Drawings (LOD200/300) + 3D Model in Revit

3D Federated Model fully coordinated Architectural, Structural and MEPF in Revit-

Base on the following assumption : DD design Models shall be LOD200 – CD design Models shall be LOD300

DD + CD Façade:

DD+ CD for Vertical Transportation

DD+ CD for Structural :

DD + CD For MEP Shell and Core :

DD + CD for ID

Development of BIM Structural Model

The development of the BIM Structural model is fairly straight forward, and focuses mainly on the coordination between Architect and MEP Engineer, and later the Interior Designer. The structural model is of great importance with regard to the development of MEPF layouts, and the clash detection exercise, which will be used to determine where services must be diverted, or whether certain services may be able to pass through certain structural elements.

For LOD 200, the following will be achieved:

Complete structural framing plans, inclusive of beam, slab and column marks, dimensions, setting out of critical items, slab drops, and the like. The Revit model will be completely 3-dimensional. Stairs, ramps etc., will also be incorporated into the model.

Major known penetrations will be incorporated into the model, but it should be noted that there is still scope for adjustment as the detailed vertical layout of services does not occur until the development of the BIM model in LOD300.

For LOD 300, the following is expected:

setting out of structural elements will be verified and adjustments made in accordance with the other disciplines. The LOD300 model will also incorporate further optimizations made by the designer with regard to member sizes, etc. Support details shall also be incorporated for façade fixings, windows, curtain wall, etc.

Structural steelwork shall also be further developed, including detailed drawing of connection details, joints, and the like.

Detailed penetrations shall be incorporated into the model to show where clashes have been mitigated

It is, however, envisaged that the RC details shall remain generated in AutoCAD 2D and not incorporated into the BIM model. It is normally more beneficial to maintain a 2D traditional delivery of RC details to the contractor.

The Steel Structures will be modeled in TEKLA to cover the steel structural supports and connection details to LOD 400.

Architectural and MEPF Construction Design (CD) Drawings will be modelled to LOD 300.

TYPICAL High Rise Building Information Models

Residential - Hotel and Casino Sydney



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Developing the Structural Framing



Developing the MEPF System and reviewing for COORDINATION

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Developing the TOWERS MEPF RISERS systems and reviewing or coordination

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Overall review of the Project MEPF Systems Base Build for Coordination and Correctness

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Developing and Reviewing Tower and roof top Plant for coordination and correctness

Engcorp Ltd



Overall review of the Project MEPF Systems Base Build for Retail Podiums Coordination and Correctness



Developing and reviewing the Structural Framing – Steel and Concrete

Engcorp Ltd



Developing and review of the Structural Framing steel and Concrete

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Coordinating the MEPF Systems Design and Structural Design – Structural Openings in Slabs and Risers

MEPF Systems can be Quantified at each floor level



Coordinating MEPF Systems and Structure

Measuring the Height and Quantity of MEPF Systems



Coordinating MEPF systems and Structure in Retail Podiums



Developing the Architectural Curtain walls and Façade



Developing the Architectural Models

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Developing the Architectural Details

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Reviewing and Analyzing the Structure



TG2(4)T-A(2) : Level 68 FFL

Reviewing and Analyzing the Structure

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Level of Development

The Level of Development (LOD) describes the information and geometry of elements within the model that may be utilized through the authorized uses of the model at the current phase of the project. LOD's allow for an understanding of model content requirements and the reliability of the content is established and understood by all stakeholders.

Fundamental LOD Definitions

LOD 100	Schematic Model	The Model Element may be graphically represented in the Model with a symbol or other
		generic representation, but does not satisfy the requirements for LOD 200. Information
		related to the Model Element (i.e. cost per square foot, tonnage of HVAC, etc.) can be
		derived from other Model Elements.
LOD 200	Design Model	The Model Element is graphically represented within the Model as a generic system,
		object, or assembly with approximate quantities, size, shape, location, and orientation.
		Non-graphic information may also be attached to the Model Element.
LOD 300	Design Model	The Model Element is graphically represented within the Model as a specific system,
		object or assembly in terms of quantity, size, shape, location, and orientation. Nongraphic information may also be attached to the Model Element.
LOD 400	Approved for Construction	The Model Element is graphically represented within the Model as a specific system,
	Model/Fabrication model	object or assembly in terms of size, shape, location, quantity, and orientation with
		detailing, fabrication, assembly, and installation information. Non-graphic information may also be attached to the Model Element.
LOD500	As built Model	The Model Element is a field verified representation in terms of size, shape, location,

quantity, and orientation. Non-graphic information may also be attached to the Model

Elements.

Project Level-of-Development LOD (for Design Model)

The agreed level of Development for the project:

Discipline LOD

Architecture	LOD 300
Structural Concrete	LOD 300
Structural Steel	LOD 400
Mechanical	LOD 200/300
Hydraulic	LOD 200/300
Fire Services	LOD 200/300

By using BIM tools for a 3D designed environment allows the client team/ PMU total visualization and control of the Project Design and most importantly control of the Contractor, Construction phase to handover and building phased occupation.

Click this link to see Crown Casino Sydney MEP https://drive.google.com/open?id=0B0ZhyJNvCJa1QnNjTDgwLWZVQIE

Click this link to see Crown Casino Sydney Structural https://drive.google.com/open?id=0B0ZhyJNvCJa1eXNUUIRINFRLODA

Click this link to see Crown Casino Sydney 4D Time Scheduling https://drive.google.com/open?id=0B0ZhyJNvCJa1bWtvdWJWeWpPUDg

Please review this document 'BIM For High Rise Developments Vietnam' we have prepared for you and analyze the information carefully. It explains why and how this process is performed and the benefits.

We look forward to speaking with you further. Peter Nicolson

For Engcorp Ltd

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Addendum 1

Explaining the BIM Process

