

# BIM

## e – Submission Guideline

### Structural

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While BCA tries to highlight the major points of submission requirements, BCA cannot take into account all the special cases in other regulatory agencies as well as the changing technology. Updated versions will continue to be issued to address and incorporate on-going feedback in an open, collaborative process. All readers of this guide are encouraged to submit feedback to BCA CORENET.

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Revision #	Revision Date	Summary of Changes	Remarks
1.0	October 2010		Issue to Pilot Participants
2.0	April 2011	Revision History incorporated Updated Table of Contents Revised as per comments & suggestions of Pilot Users	For official BIM eSubmission
2.1	April 2011	Formatting Changes & Minor Revisions Description of steps to create content has been removed and added to Annex 1a and Annex 1b	

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# 1. General Information & Requirements

Building Information Modeling (BIM) is a process of generating and managing building information during the lifecycle of a building/facility. Typically, it involves the use of three-dimensional (3D) building modeling software to produce a Building Information Model (also abbreviated as BIM), which encompasses building geometry, spatial relationships, geographic information, quantities and properties of building components.

This document outlines the specifications required to prepare the building information model in BCA BIM e - Submission format. BCA has worked with the various software vendors to develop “templates” that will help to manage project information to meet BIM e - Submission format.

## 1.1. BIM e - Submission Packages

For BIM e - Submission, Qualified Person (QP) is required to compile all drawing views/sheets of a project into two (2) separate DWF/PDF files for submission.

- a) FileName1.pdf/dwf  
This file includes general notes, floor plans, elevations, sections, schedules, and details compiled in sheets with title block. This file is for approval.
- b) FileName2\_REF.pdf/dwf  
This file includes architectural drawings (floor plans, elevations, sections, etc.), structural 3D model, structural site plan and supplementary views. This file is for reference only.

The diagram below illustrates conceptually, the differences between current e - Submission with 2D documents against BIM e - Submission.

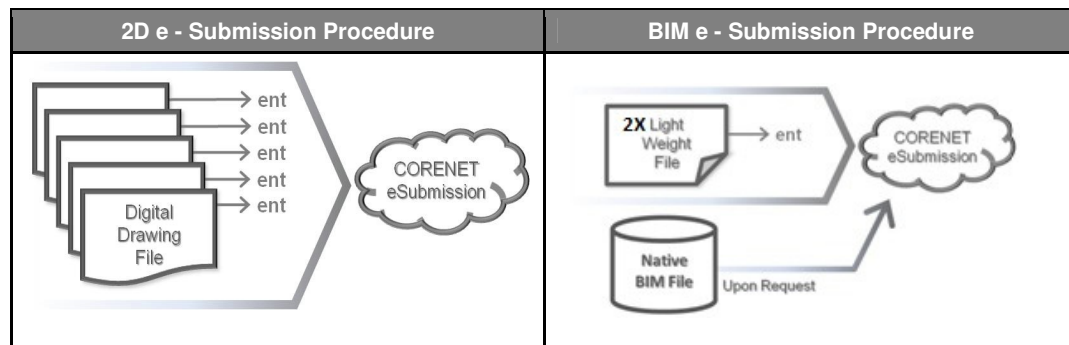


Figure 1 – Comparison between 2D Submission VS BIM e - Submission

## 1.2. File Format and Size

DWF/PDF files are non-editable formats. Hence the content cannot be tampered with so as to preserve the integrity of the files. In other words, the two files are the static equivalent of the BIM native file.

The QP is advised to keep a copy of the files in the native format as BCA reserves the rights to request for verification purpose.

DWF/PDF formats are also light weight file as compared to the native file.

QP is advised to reach CORENET help desk in case of large file.

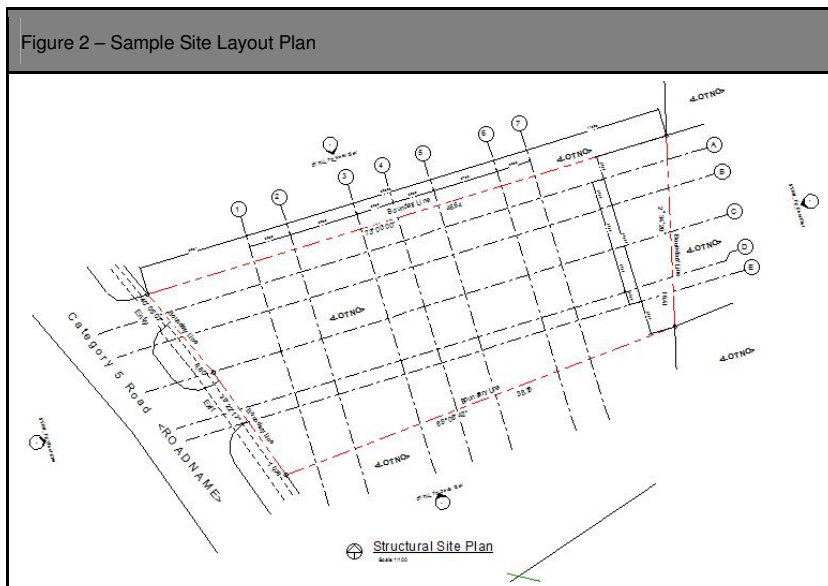
### 1.3. Project Model Scale

When modeling a building/structure in the BIM software<sup>1</sup>, QP is required to create the BIM model in 1:1 scale. QP is also required to use a consistent unit of measurement within the entire BIM model.

### 1.4. Site Layout

The site layout shall include the following:

- a) Project Gridlines: they must be added to the site plan
- b) Site Boundary: includes adjacent property lines, town subdivision, mukim & lot numbers, street names, ingress & egress to site
- c) Building Outline: the outline of the building to be constructed



The site plan shall be positioned in real world coordinates (x, y, z values) with site orientation aligned to True North. This information is usually available from the land survey plan or architectural plan/model.

The orientation for the rest of the Structural floor plans is Project North.

\*Note: Units of measurement for most land survey plan are in “meters” whereas architectural plan/model are in “millimeters”.

### 1.5. Project North Orientation

In most cases, QP prefers to work on a project orientation aligned horizontally for easy visualization by adopting a Project North. All sheets, except the Site Layout, in the BIM e - Submission file can be aligned to Project North. The Site Layout as per section 1.4 above must be presented in True North or real-world orientation. QP does not need to physically rotate the project model because most BIM software can manage the two orientations.

<sup>1</sup> BIM software used in Singapore includes Autodesk Revit Structure, Bentley Structure Modeler, Tekla Structure. This list is not exhaustive. New software will be progressively included to the list after verification & testing.

## 1.6. Project Elevation Datum

Project Elevation Datum must be aligned to “Singapore Standard Elevation Datum (>100m)”, and not placed on ground zero (Elev +0.0). There is no need to physically move the model to the actual elevation because one can establish this value in the BIM software.

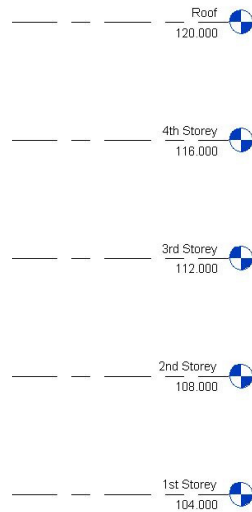


Figure 3 – Project Elevation Datum

\*Note: Unit of measurements for “Singapore Standard Datum” is usually represented in “meters” while BIM unit settings maybe in “millimeters”.

## 1.7. Standardized File Naming

BIM e - Submission adopts SS-CP83, Part 3 to manage naming of files. For full details please refer to SS CP83 documents.

The file naming convention is divided into 6 parts, where Part 1 to Part 5 is delineated by an underscore “\_” and they are mandatory fields. Part 6 is optional but it is recommended for use to give better description to the file followed by the file extension which represents the file format.

Mandatory					Optional	
Part 1	Part 2	Part 3	Part 4	Part 5	Part 6	
Project ID	ST #	Author	Zone	Version	User Defined	
A1100-00001-2011	ST01	G	01	A	Foundation	
A1100-00001-2011	ST02	S	01	A	Superstructure	

Table 1 – Abbreviations to use in File Naming Convention

Name of Field	Number of Characters	Indicators	Description
Project ID	6 min 14 max	A0000-00000-2011	Project Reference # (14 digits). If Project Ref # is not available, a minimum of 6 characters will suffice.
Author	1	G	Geotechnical Engineer (PE /QP)
		S	Structural Engineer (PE/ QP)
		X	Contractor (PE)
Zone or Block	2	NN	Where N: zone or Block Number Eg. 01 for Block 1, A1 for Zone A1
		--	For all blocks
Version	1	A	1 <sup>st</sup> Submission (original)
		B	2 <sup>nd</sup> Submission (revision or resubmission)
		C	3 <sup>rd</sup> Submission(revision or resubmission)
User defined	----	----	User defined code (Optional)

## 1.8. Standardised View Naming

In all BIM software, 2D plan views can be represented as cut sections of the 3D model. These views are automatically generated from the 3D model.

For every submission drawings, there will be composition of views and sheets with the relevant annotation information embedded so that downstream users (contractors, fabricators, precast plants) can utilize the same 3D model for their respective works. To facilitate unambiguous understanding to these views for regulatory approval as well as information sharing among project members, we need to adopt a standardised naming convention. This section covers standardised format that must be adhered to strictly.

## 1.8.a. View Naming

View naming is divided into 3 parts, each part is delineated by an underscore “\_”. All parts of this naming convention are mandatory and you are advised to strictly follow. The figure shown below is a sample in naming a view. To better understand “View Naming”, see Table 2.

Part 1	Part 2	Part 3
Discipline	View	User Defined
STRU	FP	1 <sup>st</sup> Storey Plan View
STRU	FP	2 <sup>nd</sup> Storey Plan View

Table 2 – Naming Convention for each Drawing View

Field Name	Characters	Indicators	Description
Discipline	4	ARCH	Architectural Drawings
		STRU	Structural Drawings
		MEPS	Building Services Drawings
		Others	Additional disciplines not included but required
View	2	SP	Site Plans
		FR	Roof Plans
		FP	Floor Plans
		FE	Elevation Plans
		FX	Cross Section Views
		3D	3D Views
		DT	Detail Views (rebar details, steel connections etc...)
		LV	Layout View ( text only-ex. AC, QP & PE declarations)
User Defined	4 (min)	This part describes the view. Some suggestions are listed below	
		1st Storey 2nd Storey 3rd Storey nth Storey Roof	Where n = Storey Number
		Mezzanine N	Where N = Mezzanine number
		Basement N	Where N = Basement Number
		Elevation X or X Elevation	Where X = Directions (eg. East, West, North, South or 1, 2, 3, 4)
		Section N	Where N = Section Number



## 1.8.b. Sheet Naming

Sheet naming is divided into 2 parts, each part is delimited by an underscore “-“. All parts to this naming convention are mandatory and you are advised to strictly follow.

Part 1				Part 2
Sheet Number				User Defined
0	0	1	_	BCA/ST/001/GENERAL NOTES
0	0	3	_	BCA/ST/005/TYPICAL DETAILS
0	1	0	_	BCA/ST/010/LAYOUT OF PILES AND PILECAPS
0	5	0	_	BCA/ST/020/1st STOREY BEAM SCHEDULE

Table 3 – Naming Convention for individual Sheets

Field Name	Number of Characters	Indicators	Description
Sheet Number	2 (min.)	10	Sheet # 10. This must tally with the sheet reference on the Title Block
User Defined	4 (min.)		This part use to describe the sheet Some organization associates this part with the “Drawing Number/Reference” in the title block followed by a descriptive text to explain the purpose of the sheet.

## 1.9. Last Saved Views

Checking and approval from the regulatory agency will be based on the last saved views of your project model. QP is advised to ensure that the following actions are done before exporting to DWF/PDF file.

- Maximize all project views extent before saving
- No hidden objects or annotations
- Any external links such as imported 2D drawing files, 3D models from other disciplines (Architecture, MEP, etc.) & 3D models linked from external locations that are part of the submission must be visible. There should not be any missing links.
- All other external reference objects regardless of layers, annotations, drafting views and construction lines which reside on the 3D Model and has no bearing to the submission must be removed or purged before compiling the sheets for submission.
- Do not use propriety fonts for annotations & texts. All fonts must be legible.
- All objects and annotation for each phase must be displayed in the last saved view.
- If a project falls under Addition & Alterations (A&A), ensure the relevant phase have been activated with the right color coding (refer to SS CP83 for guidelines).

## 1.10. Addition and Alteration Projects

Working on A&A projects, it is required to demarcate your 3D model in accordance to SS CP83 Part 5 by applying color identifier (see Table 1) to all objects. In most BIM software there is no need manually change the color of these objects; it can be configured virtually through Phase Settings or View Configuration.

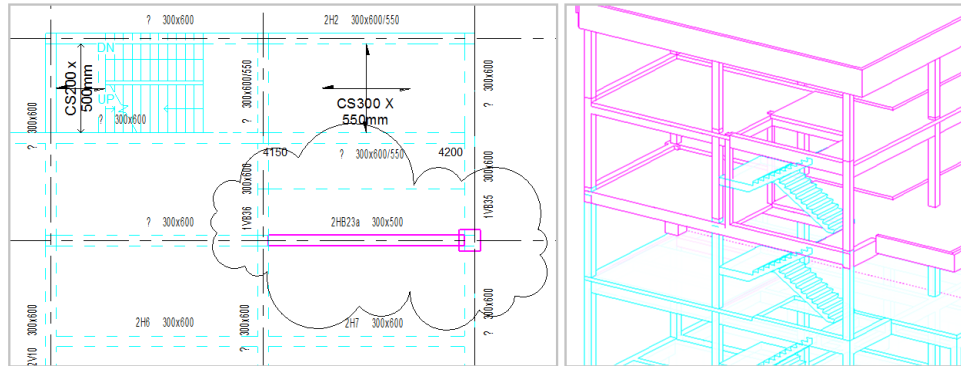
To present an A&A project as per SS CP83 guidelines, any part of the building that is to be demolished, must be presented as dotted lines on all views. A sample of this requirement is illustrated in Figure 4.

Table 1 - A&A Projects Element Color Coding

Colour	Usage	Remarks
Magenta	Proposed Elements	All additional works on existing structure which are added as new objects in your model
Cyan	Existing Elements	All existing parts of a building/facility
Yellow	Deleted Elements	All parts of a building/facility that has to be removed, before additional works can be carried on existing structure.

To highlight specific components/objects in an A&A works, it is recommended to provide “cloud marks” over the areas that will be affected as shown below.

Figure 4 - Sample of A&A Project / Project for resubmission (2D and 3D Views)



## 1.11. Project Resubmission

In the event your BIM submission has comments and/or clarifications from the BCA processing officers, the user is required to resubmit the compiled drawings in a light weight file.

- Revision cloud to highlight the changes made to comply with BCA comments
- Color coding similar to A&A requirements for any design changes.

File naming for resubmission shall follow the naming convention as per Item 1.7 above.

## 1.12. Project Drawings Basic Composition

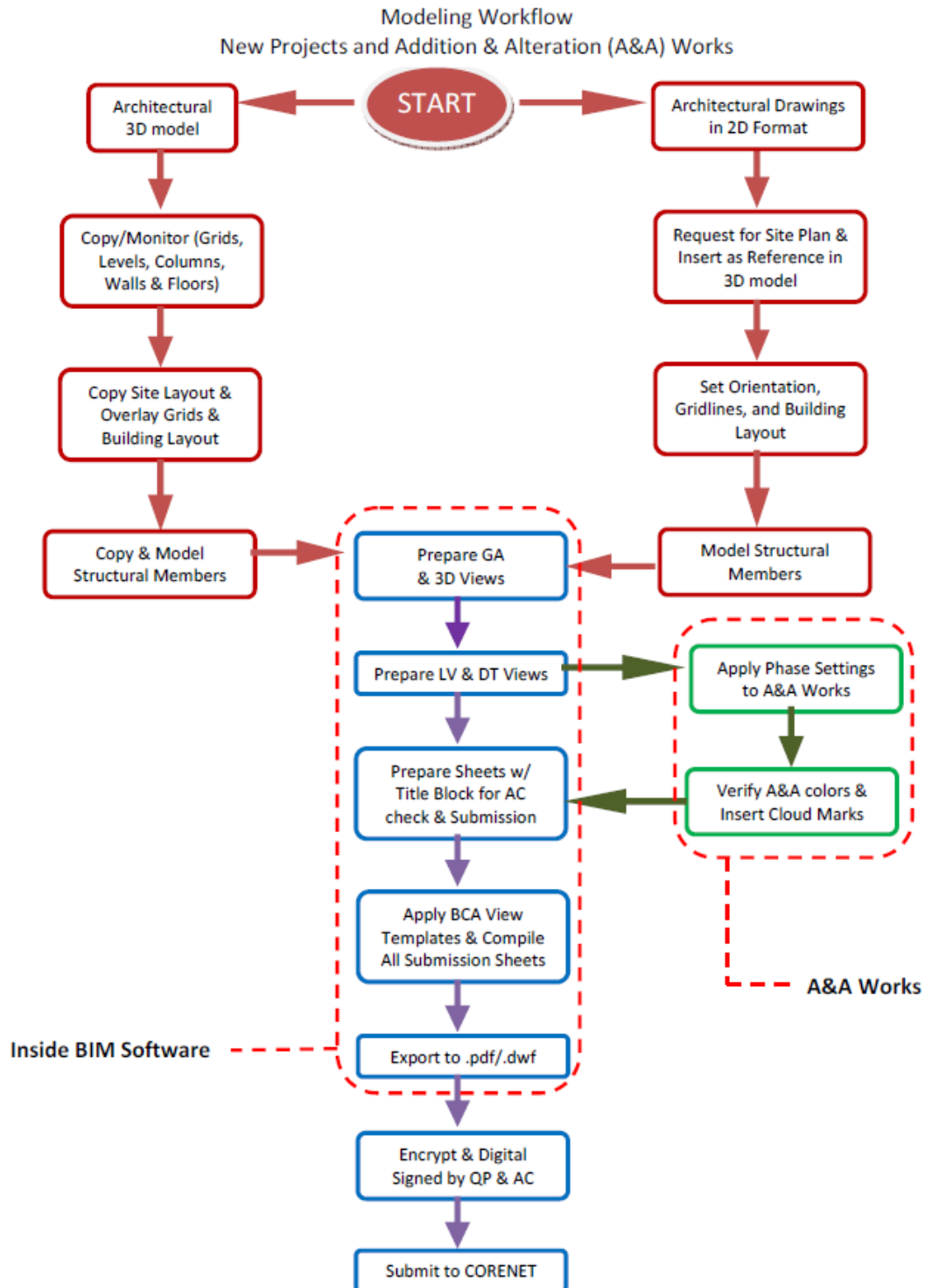
In BIM software, a windows explorer like browser (or navigator) can be found where a list of generated “Views” is arranged. These “Views” are used to compose individual sheets with Title Block. Once the sheets are ready for submission, they are compiled and exported unto a single light weight file in either DWF or PDF format. These files are then digitally signed, encrypted and transmitted to BCA via CORENET.

Table 5 – BCA View Category Naming Convention

Ref	BCA-View-Category	Types of View	View-Name (Sample)	Remarks
1	ARCHITECTURAL	Plans	ARCH_FP_1 st Storey	
		Elevations	ARCH_EL_North View	
		Sections	ARCH_FX_A-A	
		Details	ARCH_DT_Window Frame	
2	SITE	Plans	STRU_SP_Site Layout	
3	STRUCTURAL-GA	Plans	STRU_FP_3 rd Storey	
4	STRUCTURAL-DT	Details	STRU_DT_2HB45-2HB27	
5	STRUCTURAL-EL	Elevations	STRU_EL_Front View	
6	STRUCTURAL-FX	Sections	STRU_FX_B1-B1	
7	STRUCTURAL-3D	3D View	STRU_3D_Shaded View	
8	SHEETS (ALL)	Sheets	05 - S_MS/D/01_Misc Details	Only Sheets required for current ST Approval.

### 1.13. BIM Modeling Workflow

This section suggests a modeling workflow within your BIM software. Details may vary from one BIM platform to another. Please consult you software vendor or IT support.



## 1.14. Structural BIM e - Submission Checklist

- Project Information
- Site Plan in True North (Boundary, Grids, Adjacent Roads & Properties, and Building Outline)
- Architectural Plans in Project North
- General Notes
- Structural GA - Floor Plans in Project North, Elevations and Sections
- Area Load Plan
- Structural Details
- Schedules
- Sheets with Title Block (with correct sheet numbers and declarations)
- File, View and Sheet Naming conventions are correct
- Exported to 2 DWF/PDF files
  - <FileName>.pdf/dwf – Sheets that requires approval.
  - <FileName>\_REF.pdf/dwf – Other sheets/views including 3D model for reference only

## Glossary of Acronyms and Terms

The following is a list of acronyms and terms used within this document. Take note that some of the terms are of local context and may not have the same connotation when used elsewhere.

No.	Acronym / Term	Definitions
1	A&A	Addition and Alteration
2	AMSL	Above Mean Sea Level
3	BIM	Building Information Model
4	CAD	Computer Aided Drafting
5	CSC	Certificate of Statutory Completion
6	DWF	File format known as "Design Web Format" that is light-weight and non-editable. Refer to <a href="http://www.autodesk.com">www.autodesk.com</a> for more information
7	IFC	Industry Foundation Class. Refer <a href="http://www.iai-singapore.org">www.iai-singapore.org</a> for more information
8	GFA	Gross Floor Area
9	Legend	A list of various building components and annotations used in a project
10	QP	Qualified Persons / Practitioner. Usually a Professional Engineer (PE)
11	RVT	File format created by Revit from Autodesk. Refer to <a href="http://www.autodesk.com">www.autodesk.com</a> for more information
12	SS CP	Singapore Standard Code of Practice
13	Sheet	The composition area of a CAD drawing environment. Individual sheets are created using the created views from the 3D model and placed inside a Title Block
14	Schedule	A tabulated display of information
15	TOP	Temporary Occupation Permit
16	View	Orientation of the project model from the angle of a viewer, for instance "Floor plan view", "Elevation view and Sectional view" as well as "3D view".
17	PDF	File format which is light-weight and non-editable, developed by Adobe. Refer to <a href="http://www.adobe.com">www.adobe.com</a> for more information
18	DGN	File format created by Microstation from Bentley. Refer to <a href="http://www.bentley.com">www.bentley.com</a> for more information
19	DWG	File format created by AutoCAD from Autodesk. Refer to <a href="http://www.autodesk.com">www.autodesk.com</a> for more information
20	GA	General Assembly. Refer to Floor Plans, Elevations, Section Views etc.....

## Acknowledgement

A collaborative effort among a panel of knowledgeable Industry Consultants & QPs, Software Vendors and Processing Officers, has contributed significantly to the successful development of this document. They are:

### Regulatory Agency

#### **Building and Construction Authority**

- Building Engineering Division
- Special Functions Division, Civil Defence Shelter Engineering Department

### Participating Organizations & Software Vendors

- LSW Consulting Engineers Pte Ltd
- ARUP Singapore Pte Ltd
- BECA Carter Hollings & Ferner (SEA) Pte Ltd
- Autodesk Asia Pte Ltd
- Tekla (S) Pte Ltd
- Bentley Systems Pte Ltd.

## Notes

As most software gets updated on a regular basis, please contact your software vendor for assistance, if you encounter difficulties relating to the software products.

## Annexes

In conjunction with BIM software developers, BCA has developed a recommend process and template training guide.

- Annex1a – Recommended Process – Revit 2010
- Annex1b – Template Training Guide – Revit 2010
- Further Annex will be added for the respective BIM tools