



# ARCHITECTURAL BIM GUIDE v 1.0



## Synopsis

The Public Procurement Service (hereafter referred as The PPS) announced “BIM guidance for application” to order for the public competitions and turn-key based constructions at October 17th, 2010. BIM guidance by The PPS is focusing on reducing the burdens in the industrial market resulting from new technology adaptation. This purpose will be acquired by requesting submission procedure and qualified details of BIM applied product and the scope of BIM application on each design stage. It also aims to save cost and boost “Green Construction” in public area by requesting BIM applied building energy efficiency, energy simulation and basic quantity takeoffs.

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# 1. Outline

## 1.1 Principles and Purpose

### A. Purpose

The purpose of “Public Procurement Service BIM guidance for application” (hereafter referred as “This guide”) is to define the minimum requirements for applying BIM technology at competition stage and design development stage, and supply standards for BIM business to utilize BIM data at construction and organic management stage.

### B. Principle of Open BIM Application

Open BIM is applied at competition stage and design development stage of PPS industry. The Open BIM means the BIM that can share and exchange model information by various software which supplies the accepted international standard (ISO/PAS 16739). Open BIM is applied for verification, management and re-usage of BIM data generated in various software environment (type, version etc.) by contractors at standardized environment.

## 1.2 Guidance’s Composition

This guide includes the following contents

### A. BIM Management Guide of PPS

It means the guide for management of completion and design development of business inside PPS.

### B. BIM Application Guide for Design Competition

It means the guide necessary for the BIM business application of applicants at design competition stage.

### C. BIM Application Guide for Bidding at Basic Design Stage

It means the guide necessary for the BIM business application of bidders at basic design stage.

### D. BIM Application Guide at Design Development Stage

It means the guide necessary for the BIM business application of competition or design qualifier at design development stage.

### E. BIM Application Guide at Construction Stage

It means the guide necessary for the BIM business application of contractor at construction stage.

## 1.3 Associated References and Standards

This guide is applied as part of PPS’s business guide and assignment. The contents which do not include in this guide should apply construction handbook, technology business menu and other contents appointed by PPS.

## 1.4 Terminology

The definition of terminology which used in this guide shows as follows.

- A. “BIM” covers geometry, spatial relationships, light analysis, geographic information, quantities and properties of building components. BIM can be used

to demonstrate the entire building life cycle, including the processes of construction and facility operation. Quantities and shared properties of materials can be extracted easily. Scopes of work can be isolated and defined. Systems, assemblies and sequences can be shown in a relative scale with the entire facility or group of facilities. Dynamic information of the building, such as sensor measurements and control signals from the building systems, can also be incorporated within BIM to support analysis of building operation and maintenance

- B. "IFC" means the data model intended to describe building and construction industry data. It is an object-based file format with a data model to facilitate interoperability in the building industry, and is a commonly used format for Open BIM. It is the official International Standard ISO 16739.
- C. "Spatial Object" means the BIM object that utilized and defined floor, area and room of the buildings.
- D. "Competition Stage" means the stage from the preparation of design completion and bidding to the qualifier is selected.
- E. "Part Object" means the BIM object used for expression of physical factors of building compositions.
- F. "Deliverable" means the collection of material finally submitted to owners.
- G. "Reservation Spatial Object" means the spatial object used for the beforehand assurance of the setting space of components like electricity or equipment.
- H. "Temporary Bench Mark" means the bench mark set temporarily at construction site or design area.

### 1.5 Acronym

The definition of acronyms which used in this guide shows as follows.

- A. BIM : Building Information Modeling
- B. ISO : International Organization for Standardization
- C. IFC : Industry Foundation Classes
- D. TBM : Temporary Bench Mark
- E. TM : Transverse Mercator

### 1.6 Revision of Guidance

- A. Revision  
The guide can be revised according to the revision of international or national standard, development of related information technology, and change of the environment.
- B. Version Assign Standard  
This guide is managed according to the revised version. The version name should be the format vX.Y, when overall scope or the main contents are revised, X should be assigned, when part scope or the trifling contents are revised, Y should be assigned. The initial version name begins from "v1.0".

## 2 Public Procurement Service's BIM Management Guidelines (In-house)

### 2.1 BIM Management in Competition Phase

#### 2.1.1 Organization and Role

##### (1) . PPS BIM Manager

###### A. PPS' BIM Manager Appointed

PPS is the responsible department for BIM application, and to appoint the BIM manager during the construction, so as to manage BIM-related technologies and services systematically.

###### B. Role of BIM Manager

To identify BIM adoption and define the scope and level of BIM application. To define related BIM guide and BIM implementation requirement.

###### C. Outsourcing of BIM Manager

If necessary, PPS may outsource BIM professional services to support internal BIM technology and management as a part of PPS BIM manager.

##### (2) . Applicant

###### A. BIM Application

To apply BIM technology in competition stage based on the guide of request for proposal (bidding guide) or BIM guide of PPS. Interpretation and judgment of BIM guide should be guided by the PPS official inquiries.

###### B. BIM Deliverables

To submit BIM deliverables based on the requirements of PPS BIM guide, unless supplement is made.

#### 2.1.2 Overview of BIM Application in Competition Phase

##### (1) . Purpose of BIM Application

The purpose of BIM application in competition stage is to generate accurate design drawings, best and green project delivery from the proposed schemes.

##### (2) . Object of BIM Application

In competition stage, BIM guide for application is to order for the projects with cost more than 50 billion won. Buildings less than 300m<sup>2</sup> in GFA, such as gatehouse, warehouse and specified by PPS, etc., are excluded from the application.

##### (3) . Open-BIM Standard

Original file and IFC2X3 file or revised are required for BIM data submission in competition stage. IFC file will be unique when Open-BIM environment is established.

#### 2.1.3 Pre-competition Administration

##### (1) . Identification of Guide's Contents

Constitute the industrial guideline of RFP. All of RFP, lump sum bidding and BIM-based design are compulsory based on the guidance of this book. This guide is based on the project characters to detect the space programming and scope of BIM application.

- (2) . Preparation for Announcement  
The requirement of BIM guide should be introduced in the tutorial of RFP or Tender document.
- (3) . BIM Management Organization  
This organization is to execute the management of BIM implementation. The role is to provide related BIM-based inquire answer and to evaluate the BIM deliverable.
- (4) . Preparation for BIM Environment  
The following environmental requirement is to support BIM evaluation in competition stage, including IFC-based BIM data reviewer and qualified software.
  - BIM data reviewer: supporting IFC2X3 and revised file
  - Qualified software: supporting IFC2X3 and revised file
  -
- (5) . Outsourcing of BIM professional  
If necessary, PPS may outsource BIM professional services to support internal BIM technology and management as a part of PPS BIM manager.

#### 2.1.4 Competition Announcement Administration

- (1) . Competition Announcement  
It includes related tutorial of RFP or Tender document with BIM guide.
- (2) . Field Seminar  
To introduce the request for proposal.
- (3) . Questions and Answers  
According to announcement procedure and tutorial to answer the questions proposed.

#### 2.1.5 Nomination Administration

- (1) . Receive Deliverable  
Receive and summary BIM deliverables.
- (2) . Submission Requirement Confirmation  
To ensure compliance with the filing requirements of BIM guide, if necessary, applicants are requested to submit a supplement.
- (3) . BIM Deliverable Evaluation  
Based on the assessment criteria of the PPS BIM guide to evaluate the BIM deliverables, and to select winner among the applicants.
- (4) . Administration after BIM Deliverable Evaluation  
To administrate the results of BIM deliverable evaluation and provide it to audit organization, which will benefit the winner of the applicants.

## 2.2 Execution for BIM Management after Nomination

### 2.2.1 Organization and Role

#### (1) . PPS BIM Manager

##### A. PPS' BIM Manager Appointed

Play the role of BIM manager for detailed design in competition phase.

##### B. Role

To appoint a specific level of BIM and to confirm the contents of the BIM guide and to provide supervisory training and consultation and related technical support. If necessary, upon request of the supervisory to train the contractors and provide BIM support to them..

##### C. Outsourcing of BIM Manager

If necessary, PPS may outsource BIM professional services to support internal BIM technology and management as a part of PPS BIM manager.

#### (2) . PPS Supervisory

##### A. To Supervise the design process

Based on the PPS BIM guide, to determine the contents of "BIM implementation Proposal" submitted by the winner, and guide the contractor after the contract. If necessary, the contractor can require the support of PPS BIM manager.

##### B. To Check the BIM deliverable

To check the quality of BIM deliverable, if it is deemed insufficient or irrelevant, the contractor will be requested to modify or supplement.

#### (3) . The Contractor

##### A. BIM implementation

Based on the PPS BIM Guide and the BIM implementation proposal submitted to implement the BIM application. During the process, the contractor can require the PPS supervisor's consultant with the contents and scope of work.

##### B. BIM Quality Manager Appointed

The contractor specify the BIM quality manager among the internal organization, who is responsible for the BIM quality control.

##### C. BIM Deliverables

Based on the requirement of BIM guide and the delivery method required by PPS to submit the BIM deliverables. If the submittals need modifying or supplementing, it will still be based on the BIM guide.

### 2.2.2 BIM Management in Schematic Design Phase

#### (1) . BIM Management in Schematic Design Phase after Nomination

The scope of BIM application in Schematic Design phase is based on the minimum requirement of "BIM tutorial for lump sum of schematic design" in this guide. The detailed will be decided by the consult with PPS supervisor.

#### (2) . BIM management in Design Development Phase



Based on the review of schematic design to modify and complete the schematic design. The contractor can consult with the PPS supervisor with the BIM application scope after the schematic design.

### 2.2.3 BIM Management in Design Phase

- (1) . Overview of BIM Management in Design Phase
  - A. Purpose of BIM Application  
The purpose is to deliver high-performance project with constructability, good quality and sustainability.
  - B. Object of BIM Application  
The object of BIM application in design phase is to be consistent with the competition phase.
  
- (2) . Contract Management
  - A. Confirm the Guideline of BIM Application in Design Phase  
PPS BIM manager provide the consult and supervise for this guide, and confirm the guideline with contractor in design phase. The contractor implements BIM application based on the confirmation.
  - B. Provide the Guide to Contractor  
PPS BIM supervisor provides the confirmed BIM guide to the contractor.
  - C. The Establishment and Submission of “BIM Proposal”  
The contractor based on this guide to plan the BIM implementation and consult with PPS BIM supervisor. The final “BIM Proposal” should include the BIM implementation plan and submit to PPS BIM supervisor.
  - D. BIM Application of Contractor  
The contractor introduces the “BIM Proposal” to project participants, and masters the content in mind.
  
- (3) . Design Process Management
  - A. Contractor’s BIM implementation  
The contractor implements the BIM in the project based on the PPS BIM Guide and the BIM implementation proposal submitted.
  - B. Contractor’s BIM Guide Management  
PPS supervisor will carry out the BIM management and supervision based on the PPS BIM Guide and the BIM implementation proposal submitted.
  
- (4) . BIM management after the detail design
  - A. Quality Check for Contractor’s Submission  
Contractor’s BIM deliverables should be conduct quality control before submission.
  - B. Submission of Contractor’s Delivery  
The contractor’s BIM deliverables after quality checked should be submitted to PPS with the” BIM Quality Check Report”.
  - C. Inspection of PPS

PPS will conduct the quality inspection for contractor's BIM deliverables.

D. PPS Supplement Request

If necessary, PPS will request to provide supplementation for BIM deliverables based on the inspection.

E. Contractor's Complementation and Verification

Contractor will complement the BIM deliverables based on the PPS' requirement for supplementation. And the supervisor will determine the result.

F. BIM deliverables submission in the detail design phase

The contract obtains the approved acceptance of PPS, and the BIM deliverables submission is finished in the detail design phase.

## 2.2.4 Quality Management in the Detail Design Phase

### (1) . General Principles

A. Apply the Principles of Quality Management

Apply the quality management of the BIM guide in design phase.

B. Implementation of Quality Management

Make the quality plan for BIM quality management and conduct quality verification, including but not only limited in object, duration, benchmark and methods, which involve in BIM Proposal.

C. Quality Assurance

The quality assurance is divided into contractor's quality check and PPS' quality inspection.

### (2) . Classification of Quality Assurance

A. Quality Check

Advanced quality check performed by contractor prior to submit, within the scope of BIM Proposal, BIM data for generate design drawings or various data analysis. PPS supervisor will consider the times and duration of project according to the size of the project to make decision. The BIM Quality Check Report will be submitted for references during the quality inspection.

B. Quality Inspection

Quality inspection performed by PPS, which is based on the BIM Quality Check Report to confirm the quality of BIM data, and supplementation may be requested if necessary. The contractor will resubmit according to the supplementation requirement, the results of the request and determine whether to perform a shutdown after the inspection.

### (3) . Quality Standards

A. Quality Management Targets

The quality management targets will be consulted between the contractor and supervisor to confirm, which should be included in the BIM Proposal. At this phase, the scope of quality management for each of the source and IFC files can be separately determined

- Quality of physical information: the shape of the model adequacy

requirements (e.g. interference, collisions, etc.)

- Quality of logical information: the logic of the model adequacy requirements (e.g. the main design criteria)
- Data quality: the data requirements of the model adequacy (e.g. object, property, grants, etc.)

B. Quality Management Standards

The quality management standards of facility industry is based on this BIM guide

(4) . Method of Quality Assurance

A. Manual Method

Manual method depends on the human direct observation and verification of the targets, in this case, BIM viewer is used.

B. Automatic Method

Automatic method depends on the software capabilities to verify automatically. The conditions and rules should be prepared before conducting quality check.

(5) . Data Format Used for Quality Assurance

A. Original Format Utilization during the Business Process

Quality check during the business process should be carried out by contractors according to the software selected by them.

B. Utilization of IFC Format when Delivery

When delivery, the object of quality check is the quality management scope of IFC file decided in the initial stage. The contractor should use the software for IFC quality checking and then make and submit the "BIM quality check report". Supervisor should carry out the quality verification of the IFC format by referring to the report.

(6) . Duty Scope of BIM Data Quality

A. Quality Responsibility

BIM 데이터 품질검증 절차가 모든 설계품질을 보장하는 것은 아니며 The contractor should take responsibility for the design quality

B. Problem Handling during IFC Transformation

If there are problem appears during IFC transformation, the BIM data maker should confirm whether it is the problems in the data producing process, the final problems should be recorded in "BIM result report"

### 3 BIM applied Competition Guidelines (Applicant)

#### 3.1 Outline

(1) . BIM Application Purpose

The purpose of BIM application in Design Competition phase is to enhance the design quality with minimum quality issues and ensure the accurate plan and drawings of design proposal to boost eco-friendly design.

(2) . Object of BIM Application

The object of BIM Application includes the building and site. The buildings of less than 300m<sup>2</sup> (such as gatehouse, parts warehouse and designated the building as a PPS in order) are excluded from the application.

(3) . Scope of BIM data

Construction of buildings and structural elements are targeted.

(4) . Goals and Level of Detail

Goals	Level of Detail
Design Review	- Building exterior design review - Building key interior design review
Quality Enhancement	- space conditions ensure adequacy - the main design criteria ensure adequacy
BIM Drawings Generation	- generate accurate design drawings
Energy Efficiency Verification	- outline the energy efficiency of building envelope performance analysis (Heat Gain and Heat Loss Heat Load Calculation)

#### 3.2 Requirements for BIM Data Preparation

##### 3.2.1 Overview of BIM data

(1) . Principle of Open BIM

Open BIM technology should be applied in design competition phase. The BIM data generated from applicants' software (type, version, etc.) can be read in a standards environment in order to review and management.

(2) . BIM Data Submission Format

BIM data is submitted over the IFC 2x3 standard formats or the original format.

(3) . The Choice of BIM Software

- A. BIM data generated software to support the IFC 2x3 or instructed software with the capability of performing work.
- B. Energy analysis software, international standards (IFC 2x3 more or gbXML) by the minimum building geometry information can be linked to the software.

##### 3.2.2 Creating a Common Database

(1) . Target of BIM Data Object input

A. The Destination of the Object

The target of BIM data input is based on the building breaking up, including but not only limited in the following elements

Field	Target of elements
Structure	- Column, Beam, Wall (carrying wall), slab, roof, stairs and slope.
Architecture	- Wall (non-bearing wall),door, window, curtain wall
Site	- Employer-provided land within the boundaries of the model elements - high and low expression of the earth - representation of parking lines, road lines - the objects out of the above are not(landscape works, tree, etc.) allowed to input

B. Principle of BIM Object Input

BIM objects are created by the type of elements separately. (e.g. columns and beams cannot be created by the same object, but to input the objects separately)

(2) . Creating the Object by Type

A. Input the Object in BIM Software by Type

BIM objects should be created in the BIM software by the related BIM software feature type in principle. (e.g. the column must be input by using the column input function in BIM software.)

B. Treatment for the Constrain

If the BIM object is constrained by the BIM software to input, the generic object will be used by the propertied definition.

(3) . Scale and Units

A. Scale

BIM data representation of the detailed drawings is based on the level of 1 / 200 to the outside.

B. Application of Level of Detail

The level of detail is equally applicable to the entire building. However, if necessary to apply different levels of detail and information in part, it should be recorded in the "BIM Final Report".

C. Unit

BIM data is used in millimeters (mm) units in principle.

D. Actual Dimension Compliance

The dimensions differences between the building and the actual element are not adjustable.

(4) . Standard of Story Input

A. Principle of the Story Unit

The building is based on the number of the story as the principle unit.

B. Principle of the Story

The distinction to the objects in the building floor area is from the upper floor slab to the bottom of the slab of the story in principle; a basement floor slab and the

foundation of the independent story are separated.

C. Objects shared among multiple stories

If the object spans multiple stories, it will be broken down by story for one unit type. If it's difficult to distinguish, it will be in the lower story.

(5) . Building Configuration File

A. File Organization

BIM data file is configured into one file by the independent building for submission in principle. If two or more buildings are connected, the BIM data file is configured to a single file for submission.

B. Separation of Specific Building Files

You can submit a separate file according to the size and complexity of the building. If necessary, you should breakdown the file.

(6) . Site and Reference Point

A. Site

The 3-D surface of the site is expressed as the relative direction of the north.

B. Temporary Bench Mark of Site

The site coordinate refer to the latitude and longitude of GIS and TM coordinates of the temporary bench mark of site.

The sample format is showed as following,

- Latitude and longitude: 00 ° 0'00 .00 "N, 000 ° 00'00 .00" E

- TM Coordinates: 00s 000000.00mE, 0000000.00mN

C. Site Coordinates

The site coordinates refer to the temporary bench mark and manage the information based on a relatively flat Cartesian coordinates (X,Y) and the ground level (GL).

D. BIM Model Baseline

BIM model to the baseline score from the appointed interim level of the ground is relatively flat Cartesian coordinates (X, Y) and the ground level (GL) and the direction of true north ("") angle so that the information is managed

E. Input Standards of Existing Building

Existing buildings is the reference to determine the mass of the building above the level to input.

(7) . IFC Property Standard

BIM data input standard for the IFC property ordered separately depending on the nature of the business are provided by appointed PPS.

3.2.3 Guidelines for Spatial Modeling

(1) . Input Destination

A. Input Object

The building space object is input by the areas and rooms based on the notice of "Space Program Code List" for each space object type specified.

- B. The published “Space Program Code List” prohibited to Change
- C. Type of Property
- D. AA.BBB.CC is a form of code structure for the room, if necessary, it can be applied to transform
  - a) AA: Facilities - Area Code (01-89, 98 public spaces) Building, group and divided into 10 units is required to distinguish
  - b) BBB: Room Name Code
  - c) CC: serial number (if you use the same room duplicate code serial number given)

Facility	Zone	Space	Space No.	Area
Building	Office	Chairman Room	01.001.01	70
		Office	01.002.01	50
		Head Room	01.003.01	50
		General Office	01.004.01	400
	Administration	Administration	02.001.01	300
		Library	02.002.01	100
...	...	...	...	
Podium	Lobby	Conference Room	11.001.01	1,000
		Warehouse	11.002.01	30
	Meeting	Big Meeting Room	12.001.01	330
		Medium Conference Room -1	12.002.01	100
		Medium Conference Room -2	12.002.02	100
		General Meeting Room-1	12.003.01	100
		General Meeting Room -2	12.003.02	35
		...	...	...

(2) . Input Method

- A. By building modeling data  
Spatial model is created while the building model is finished, and defines the space object then save.
- B. Outline of the Space  
Basis to the center lines of the wall.
- C. Meet the Area Requirement  
The space model should meet the area requirement in the “Space Program Code List”, the error to the total area is controlled in  $\pm 10\%$ , the error of each room is

control in  $\pm 5\%$ .

D. Meet the Space Requirement

It must meet the demand of space.

(e.g. a story of a specific room assignment, the minimum height and proximity to two slab, etc.)

E. Using different color for each type of facilities

Facility	Facility no.	Color	RGB
00 Facility Zone	01	Apricot	255/155/155
00 Facility Zone	02	Orange	255/175/100
00 Facility Zone	03	Yellow	250/255/100
00 Facility Zone	04	Pale Green	150/255/110
00 Facility Zone	05	Green	75/175/100
Public Facility (including Parking)	98	Blue	100/125/255
Gross Area	99	Purple	225/100/225

F. Avoid Overlap of Spatial Objects

Space should not overlap each other.

G. The adjacent of the building space is in the centerline of the next building or the other objects spaces.

H. Input the Open Upper Space

When there is an open space across multiple floors, a space name of all of open upper space is should be "OPEN".

3.2.4 Guidelines for Building Modeling

A. Input Destination

BIM data should include architectural elements and structural elements.

B. BIM data should include space objects, abiding the rules of “standard for drawing space model data“

C. Window

Window object should be under the wall objects. (the wall first, then input the window)

D. Principle of Dimensional Accuracy

The size of the building and the land cannot be adjusted arbitrarily.

E. Envelop Model

The envelope model should be sealed with external objects that outdoor air cannot be through to inside of the building.

F. Property Type of Envelop

BIM data for building envelope should be defined and IFC object property type, “IsExternal” should be set to “True”.

3.2.5 Guidelines for Site Modeling

(1) . Input Destination

Using the land model data provided (changing outside data of the boundary, the land boundary, the boundary coordinates, the direction of true north are



prohibited)

(2) . Land outside the boundaries

With the design intent, the ground height level within the site could be changed and the road and parking line can be represented. (Landscaping and other information cannot be added)

3.3 Requirements for BIM Application: Design Examination and Quality Verification on Conceptual Design in Competition Phase

3.3.1 Design Examination Application

(1) . Perspective and Aerial View Utilization

A. Image Generation Standard

In this guide, if it is not specified, only the image automatically generated from BIM software should be used.

B. Image Processing

The artificial process like changing or adding images automatically generated from BIM software is not allowed. The additions are allowed to be added just in the situation that the size and location of building factors (roof, floor, wall, door, window etc.) showed in each image of the perspective and external aerial view are not changed.

C. Color Utilization

In the contest stage, color of each image from the perspective and external aerial view can be used, usage of other color is not allowed.

(2) . Design Proposal Checking for BIM Data

A. Checking Principle

The submitted BIM data can be directly used in the design proposal checking.

B. Checking Method

The principle of design proposal checking is to check the IFC file, if necessary, the original data can be checked.

3.3.2 BIM Utilization Standard: Design Quality Assurance Utilization

(1) . Spatial Design Quality Verification

A. Requirement for Area Sufficiency

The area of spatial object should be sufficient for the "Space Program Code List" supplied in the public announcement stage, the tolerance of each area for the actual name unit should be within  $\pm 10\%$ , and the total tolerance of each region unit actual area should be within  $\pm 5\%$ .

B. Requirement for Spatial Sufficiency

If the spatial key requirement exists, it should be sufficient. (Example: configuration of special rooms, minimum height, proximity of two rooms etc.)

C. Design Requirement for Sufficiency of the Disabled

The design requirement for the disabled should be sufficient. The followings are the objects that should be sufficient.

- Accessibility of the wheel chair for the disabled.
- Ramp gradient

D. Design Requirement for Sufficiency of Refuge and Disaster Prevention

The design requirement for Refuge and disaster prevention should be sufficient. The followings are the objects that should be sufficient.

- The assurance of the appropriate path connected to each space refuge area.
- Sufficiency of the stair window, stair width, depth etc. according to the direct access stair, refuge stair and special refuge stair design principles.

(2) . Design Planning Quality Verification

If the design planning requirement about BIM data in the guide is clearly stated, it should be followed.

3.4 Requirements for BIM Application: Production of Project Deliverables

(1) . Principle of Design Drawing Generation

A. BIM Data Generation and Utilization

Drawing (including the drawing contents showed in the layouts) should be generated and utilized within the BIM data imported standard range.

B. Drawing Arbitrary Change Prohibition

Building key factors generated from BIM data should be used accordingly, arbitrary change is prohibited.

C. Allowance of Drawing Addition

Drawing generated from BIM data about characters, guides, furniture etc. can be added according to requirements.

(2) . Layout and Drawing Generation Standard

A. Layout Generation Standard

Division	Generation Standard
Aerial View, Integrated Configuration Diagram	- Landscape (including trees) and roads, parking area addition is possible
External Perspective	- Landscape (excluding trees) and roads, parking area addition is possible
Plan, Elevation, Section Drawings	- Do not draw the landscape and road, parking area outside buildings - Internal perspective can be showed (black and white images which are automatically generated from BIM data generation tools)

B. Drawing Generation Standard

Division	Generation Standard
----------	---------------------

Aerial View, Building Introduction, Area Table of Each Building, Each Floor Etc.	<ul style="list-style-type: none"> <li>- Color image of Aerial view and perspective view can be used</li> <li>- Area documents are made according to the data generated from the spatial model data.</li> </ul>
Other Drawings	<ul style="list-style-type: none"> <li>- Color image of aerial view and perspective view can be used</li> <li>- The contents outside buildings can be added black and white for the 2D drawing key requirement</li> </ul>

C. Design Specification Generation Standard

Division	Generation Standard
Common	<ul style="list-style-type: none"> <li>- Color image of aerial view and perspective view can be used</li> <li>- Area documents are made according to the data generated from the spatial model data.</li> <li>- The contents outside buildings can be added black and white for the 2D drawing key requirement</li> </ul>

3.5 Requirements for BIM Application: Preliminary Examination of Energy Efficiency

- (1) . Preliminary Examination of Energy Efficiency Implementation
  - A. The applicants should carry out the Preliminary Examination of Energy Efficiency and add into “BIM Result Report” for submission. (Later the Open BIM standard data submitted by the applicant should be utilized and the PPS can do energy evaluation directly)
  - B. The scope of the Preliminary Examination of Energy Efficiency is the thermal load based on Heat Gain and Heat Loss of the building envelope.
  
- (2) . Preliminary Examination of Energy Efficiency Method
  - A. The energy analysis should use Energyplus or DOE-2 based software. At this time, the minimum range of the BIM data application is the utilization of building geometric information.
  - B. The shape, direction, ratio of the window area in the building model data are referred as the evidence.
  - C. The function and equipment system of some special buildings are not reflected.
  - D. Import standard of climate data will be public announced specially.
  - E. Import standard about wall, door and window will be public announced specially.
  
- (3) . BIM Data Requirement Confirmation for Preliminary Examination of Energy Efficiency.
  - A. The building envelope which direct face to the outside air (external wall and the door, window, roof affiliated in the external wall) and the key object of each bottom slab should not be omitted.
  - B. Building envelope model should be consistent with the building model envelope.
  - C. Building envelope model should include the spatial data.

3.6 Requirements for BIM applied Reports

### 3.61 Generation of BIM Result Report

#### (1) . Generation of BIM Result Report

When the applicants are submitting the deliverables, the BIM result report should be generated and submitted.

#### (2) . Contents of BIM Result Report

The following contents should be included.

- Application environment: BIM business application environment
- File deliverable: list of BIM data file
- Product deliverable: list of BIM application product and detailed scope of generation contents
- Special Issues: special issue took place in the BIM business application process
- BIM data utilization proposal

#### (3) . Contents of “BIM Data Application Proposal” in the Report

Take BIM deliverable contents and standard as the basis, in the later stage, the continuous application method, usage, standard etc. of BIM data will be indicated.

### 3.6.2 BIM Business Utilization Proposal Generation

#### (1) . BIM Business Application Proposal Generation and Admission

After signing the contract, the qualifier should generate the BIM business application plan and get the admission from the PPS.

#### (2) . Contents of BIM Business Utilization Proposal

Writing of BIM business utilization proposal should consider the feature of the business enterprise, and include the following contents.

- Formation of the BIM business execution organization
- Business role of every organization
- Scope of the BIM business execution
- BIM business schedule
- Execution environment: Computer hardware, software, version etc.
- Import object: import professional field
- Import standard: import standard of every field
- Import scope: import object of BIM object and property
- Quality planning: quality assurance object, time, standard, method etc. about BIM data
- Deliverable plan: Objective and contents of final deliverable

### 3.7 Submission Requirements for BIM applied Project Deliverables

#### 3.7.1 Generation Standard of BIM Data File

##### (1) . Submission format of BIM data file

The submission format of BIM data should be the original format and IFC format.

##### (2) . Submission object of BIM data file

Data	Content	Usage
------	---------	-------

Architectural model of each building	- BIM data including spatial, architectural, structural factors	- Satisfaction evaluation of BIM basic quality key requirement - Visualization checking
Spatial model of each building	- BIM data composed of only spatial object(Only spatial object data generated from architectural model data)	- Satisfaction evaluation of spatial key requirement
Building envelope model of each building	- BIM data composed of only building envelope component and slab between floors in architectural model data - Including spatial object	- Preliminary Examination of Energy Efficiency evidence data
The whole building envelope model and site data	- BIM data including site and whole building envelope supplied by owners - Change of site boundary and the data outside the boundary, boundary coordinate, true north direction is not allowed	- Visualization checking

(3) . Name of BIM data file

Division	format	Contents	Comments
Building number	Numeral 2	- Building division - Given by the applicants arbitrarily - 00: individual building or the whole integration - 01: The first building - 02: The second building	- Necessity
Building name	Arbitrary character	- Begin with "_(underscore) - Individual building: "building" - Multiple building: building name - Whole building: "Whole"	- Necessity
Model division	Character 2	- Begin with "_(underscore) - B: The whole building model data - S: Spatial model data - E: Building envelope model data	- Necessity
File extension	Character 3	- IFC: standard format - other: original format	- Necessity

Example:

01\_main building\_B.ifc: main building architectural model data

01\_main building\_S.ifc: main building spatial model data

(4) . Applicant is not allowed to have Implication Contents

The applicant is not allowed to have implication contents directly or indirectly in all BIM data.

### 3.7.2 Submission Standard of BIM Deliverable

#### (1) . Composition of BIM Deliverable

##### A. The situation that the whole building composes as one

Folder Name	Folder Name	File Name	Comments	
BIM	Report	BIM Result Report.hwp BIM Business Execution Proposal.hwp	Hangel 2003 or revised version	
	IFC	Architectural model	00_building_B.ifc	IFC 2x3 or revised version
		Spatial model	00_building_S.ifc	
		Building Envelope model	00_building_E.ifc 00_whole.ifc (building envelope + site)	
	Original	Architectural model	Consistent with the IFC folder	Original format
		Spatial model	Consistent with the IFC folder	
		Building Envelope model	Consistent with the IFC folder	

##### B. The situation that the building composes of more than two

Folder Name	Folder Name	File Name	Comments	
BIM	Report	BIM Result Report.hwp BIM Business Execution Proposal.hwp	Hangel 2003 Version or above	
	IFC	Architectural model	01_main building_B.ifc 02_other building_B.ifc 03...	IFC 2x3 or above
		Spatial model	01_main building_S.ifc 02_other building_S.ifc 03...	
		Building Envelope model	01_main building_E.ifc 02_other building_E.ifc 03... 00_whole.ifc (building envelope + site)	
	Original	Architectural model	Consistent with the IFC folder	Original format
		Spatial model	Consistent with the IFC folder	
		Building	Consistent with the IFC	

		Envelope model	folder	
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(2) . BIM Deliverable Submission

The media and format of BIM deliverable submission should be based on the Submission Requirements for BIM applied Project Deliverables of The PPS.

(3) . Submission Requirements for BIM Deliverables

A. Virus Check

The deliverable data file should be submitted without any virus.

B. Elimination of Unnecessary Information

Some unnecessary information should be eliminated from the deliverable data file, the file size should be the minimum.

C. Composition of BIM Data Deliverable

The composition of BIM data deliverable should follow the Delivery Guide in this Guide. If the original BIM data file would be submitted, the necessary related files should also be included and submitted.

D. Uncompression of IFC File

The principle is to submit the IFC files uncompressed. If the file size is larger than 300MB, the file could be compressed with zip format and submitted.

E. Uncompression of Original File

Original BIM data file should be submitted uncompressed.

### 3.8 Duty and Responsibility

(1) . Priority of Design Drawing and BIM data

Design drawing has the priority when there is inconsistency between Design drawing and BIM data.

(2) . Responsibility of Design Drawing and BIM Data

In the event that the design drawing that has to be generated and used from BIM data, the applicants should take responsibility for the confirmation of design drawing contents.

(3) . Responsibility of IFC File Conversion

The applicants should take responsibility for the confirmation that the original files were properly converted to IFC files. The method to confirm the result shows as follows.

A. Confirm that the BIM data generated by software can be read again in the same software

B. Confirm by free public IFC file viewer

a) Free public IFC file viewer list introduction site:

[http://www.ifcwiki.org/index.php/Free\\_Software](http://www.ifcwiki.org/index.php/Free_Software)

b) IfcStoreyView:

<http://www.iai.fzk.de/www-extern/index.php?id=1134&L=1>

c) DDS-CAD Viewer:

<http://dds.no/ax10x0.xhtml>

d) SolibriModelViewer:  
<http://www.solibri.com/solibri-model-viewer.html>

e) PDF Viewer:  
<http://www.adobe.com>

C. Confirm by other IFC file checking program

(4) . BIM Data Utilization Management when Elected

After the qualification, the qualifier should abide the BIM data utilization management requirements of the PPS.

### 15.9 Checklists for the BIM Evaluation

(1) . Principle of BIM Evaluation Reflection

The evaluation of BIM data submitted by applicants should reflect the deduction requirements.

(2) . BIM Evaluation Object and Deduction Standard

The object of BIM deduction evaluation shows as follows.

Evaluation Object	Deduction Standard (Example)
Violation of Quality Verification Application Standard	Each 0.02 point, maximum X points
Violation of Design Quality Assurance Utilization Standard	Each 0.02 point, maximum X points
Violation of Design Drawing Generation Standard	Each 0.02 point, maximum X points
Violation of Deliverable Submission Standard	Each 0.01 point, maximum X points
Violation of Requirements for BIM applied Reports	Each 0.01 point, maximum X points
Total	Maximum X points



## 4. Bidding Project Basic Design BIM Application Guide (Bidder)

### 4.1 Outline

#### (1) . BIM Application Purpose

The purpose of BIM application in Design Competition phase is to enhance the design quality with minimum quality issues and ensure the accurate plan and drawings of design proposal to boost eco-friendly design.

#### (2) . Object of BIM Application

The object of BIM Application includes the building and site. The buildings of less than 300m<sup>2</sup> (such as gatehouse, parts warehouse and designated the building as a PPS in order) are excluded from the application.

#### (3) . Scope of BIM data

Construction of buildings and structural elements are targeted.

#### (4) . Goals and Level of Detail

Goals	Level of Detail
Design Review	- Building exterior design review - Building key interior design review
Quality Enhancement	- space conditions ensure adequacy - the main design criteria ensure adequacy
BIM Drawings Generation	- generate accurate design drawings
Energy Efficiency Verification	- outline the energy efficiency of building envelope performance analysis (Heat Gain and Heat Loss Heat Load Calculation)

### 4.2 Requirements for BIM Data Preparation

#### 4.2.1 Overview of BIM data

##### (1) . Principle of Open BIM

Open BIM technology should be applied in design competition phase. The BIM data generated from applicants' software (type, version, etc.) can be read in a standards environment in order to review and management.

##### (2) . BIM Data Submission Format

BIM data is submitted over the IFC 2x3 standard formats or the original format.

##### (3) . The Choice of BIM Software

- A. BIM data generated software to support the IFC 2x3 or instructed software with the capability of performing work.
- B. Energy analysis software, international standards (IFC 2x3 more or gbXML) by the minimum building geometry information can be linked to the software.

#### 4.2.2 Creating a Common Database

##### (1) . target of BIM Data Object input

###### A. The Destination of the Object

Each building part of BIM data should be input according to the prior plan. At this time, the minimum component input object shows as follows.

Field	Component Input Object
Structure	- Reinforced concrete: groundwork, column, beam, wall object(internal force wall), bottom(slab), roof, stair, ramp - Rebar: beam, column, truss
Architecture	- Wall object(non-internal force wall), secondary wall object (partition etc.), door, window, shutter, curtain wall, railing etc., patio, roof, secondary structure
Machine	- Sanitary machine - Main equipment for interior mechanical spatial checking - Except other mechanical equipment like each piping, air pipe, fire-fighting equipment etc.
Electricity	- Main equipment like electric transmission equipment for interior electric spatial checking - Main interior lighting equipment - Except other electric equipment like electric trunk line, wiring, tray etc.
Site	- Model factors inside site boundary supplied by owner - Elevation expression for site - Parking line, road line expression - Input of other object(Landscape facility, tree etc.) except above contents is not allowed

###### B. Principle of Building Part Division

All objects should be divided and input by building parts when BIM model data generate. (Example: column and beam should be divided and input but not combined)

##### (2) . Input of Building Part Object

###### A. Input based on BIM Software Utilization

Building part object should be input using the software corresponding object input function. (Example: column must be input by column input function)

###### B. Dispose when BIM Object Input Restriction

In the event that there is input restriction when input BIM object, generic object should be used and the part should be defined according to the related properties.

##### (3) . Scale and Units

###### A. Scale

BIM data representation of the detailed drawings is based on the level of 1 / 200 to the outside.

###### B. Application of Level of Detail

The level of detail is equally applicable to the entire building. However, if necessary to apply different levels of detail and information in part, it should be

recorded in the "BIM Final Report".

C. Unit

BIM data is used in millimeters (mm) units in principle.

D. Actual Dimension Compliance

The dimensions differences between the building and the actual element are not adjustable.

(4) . Standard of Story Input

A. Principle of the Story Unit

The building is based on the number of the story as the principle unit.

B. Principle of the Story

The distinction to the objects in the building floor area is from the upper floor slab to the bottom of the slab of the story in principle; a basement floor slab and the foundation of the independent story are separated.

C. Objects shared among multiple stories

If the object spans multiple stories, it will be broken down by story for one unit type. If it's difficult to distinguish, it will be in the lower story.

(5) . Building Configuration File

A. File Organization

BIM data file is configured into one file by the independent building for submission in principle. If two or more buildings are connected, the BIM data file is configured to a single file for submission.

B. Separation of Specific Building Files

You can submit a separate file according to the size and complexity of the building. If necessary, you should breakdown the file.

(6) . Site and Reference Point

A. Site

The 3-D surface of the site is expressed as the relative direction of the north.

B. Temporary Bench Mark of Site

The site coordinate refer to the latitude and longitude of GIS and TM coordinates of the temporary bench mark of site.

The sample format is showed as following,

- Latitude and longitude: 00 ° 0'00 .00 "N, 000 ° 00'00 .00" E

- TM Coordinates: 00s 000000.00mE, 0000000.00mN

C. Site Coordinates

The site coordinates refer to the temporary bench mark and manage the information based on a relatively flat Cartesian coordinates (X,Y) and the ground level (GL).

D. BIM Model Baseline

BIM model to the baseline score from the appointed interim level of the ground is relatively flat Cartesian coordinates (X, Y) and the ground level (GL) and the direction of true north (°") angle so that the information is managed

E. Input Standards of Existing Building

Existing buildings is the reference to determine the mass of the building above the level to input.

(7) . IFC Property Standard

BIM data input standard for the IFC property ordered separately depending on the nature of the business are provided by appointed PPS.

4.2.3 Guidelines for Spatial Modeling

(1) . Input Destination

A. Input Object

The building space object is input by the areas and rooms based on the notice of “Space Program Code List” for each space object type specified.

B. The published “Space Program Code List” prohibited to Change

The room code and room name in the “Space Program Code List” should not be used arbitrarily by applicants. It is possible to be added in the allowed range.

C. Input Property

The room name and room code of spatial object should be input as properties.

D. AA.BBB.CC is a form of code structure for the room, if necessary, it can be applied to transform

a) AA: Facilities - Area Code (01-89, 98 public spaces) Building, group and divided into 10 units is required to distinguish

b) BBB: Room Name Code

c) CC: serial number (if you use the same room duplicate code serial number given)

E.g.

Facility	Zone	Space	Space No.	Area
Building	Office	Chairman Room	01.001.01	70
		Office	01.002.01	50
		Head Room	01.003.01	50
		General Office	01.004.01	400
	Administration	Administration	02.001.01	300
		Library	02.002.01	100
...	...			
Podium	Lobby	Conference Room	11.001.01	1,000
		Warehouse	11.002.01	30
	Meeting	Big Meeting Room	12.001.01	330
		Medium Conference Room -1	12.002.01	100
		Medium	12.002.02	100

		Conference Room -2		
		General Meeting Room-1	12.003.01	100
		General Meeting Room -2	12.003.02	35
	...	...		

(2) . Input Method

A. By building modeling data

Spatial model is created while the building model is finished, and defines the space object then save.

B. Outline of the Space

Basis to the center lines of the wall.

C. Meet the Area Requirement

The space model should meet the area requirement in the "Space Program Code List", the error to the total area is controlled in  $\pm 10\%$ , the error of each room is control in  $\pm 5\%$ .

D. Meet the Space Requirement

It must meet the demand of space.

(e.g. a story of a specific room assignment, the minimum height and proximity to two slab, etc.)

E. Using different color for each type of facilities

Facility	Facility no.	Color	RGB
00 Facility Zone	01	Apricot	255/155/155
00 Facility Zone	02	Orange	255/175/100
00 Facility Zone	03	Yellow	250/255/100
00 Facility Zone	04	Pale Green	150/255/110
00 Facility Zone	05	Green	75/175/100
Public Facility (including Parking)	98	Blue	100/125/255
Gross Area	99	Purple	225/100/225

F. Avoid Overlap of Spatial Objects

Space should not overlap each other.

G. The adjacent of the building space is in the center line of the next building or the other objects spaces.

H. Input of the Open Upper Space

When there is an open space across multiple floors, a space name of all of open upper space is should be "OPEN".

I. Edit of the Spatial Object

If the ID or name of spatial object should be changed, the edit function of spatial object should be used to do the change. (After eliminating the basic spatial object, the new ones cannot be input)

J. Input of the Reservation Spatial Object

If space like equipment piping configuration in the design process is going to be assured, it should be input as reservation spatial object, and the related properties should be attached for the recognition of professional field.

4.2.4 Guidelines for Building Modeling

(1) . Data Standards for Architectural and Structural Model.

A. Object Input Division

Architectural and structural model should be input separately, if necessary, they can be input as integrity.

B. Including Spatial Object

BIM data should include spatial objects

C. Window

Window object should be under the wall objects. (the wall first, then input the window)

D. Principle of Dimensional Accuracy

The size of the building and the land cannot be adjusted arbitrarily.

E. Envelop Model

The envelope model should be sealed with external objects that outdoor air cannot be through to inside of the building.

F. Property Type of Envelop

BIM data for building envelope should be defined and IFC object property type, "IsExternal" should be set to "True".

(2) . Data Requirements for MEP Model

A. Object Input Division

Mechanical components and electrical components should be input separately.

B. Input of Reservation Space

The equipment or piping which do not set detailed can be input as reservation space

C. Clash Prohibition

The main piping, equipment and reservation space of mechanical and electrical model should be input without clash.

4.2.5 Guidelines for Site Modeling

(1) . Input Destination

Site model means the least component import object in this guide. At this time, input of landscape, tree etc. is not allowed.

(2) . Land outside the boundaries

If the data outside the boundaries is supplied by PPS, the applicants should not change it arbitrarily.

4.3 Requirements for BIM Application: Design Examination and Quality Verification on Schematic

## Design and Design Development Phase

### 4.3.1 Quality Verification Application

- (1) . Perspective and Aerial View Utilization
  - A. Image Generation Standard

In this guide, if it is not specified, only the image automatically generated from BIM software should be used.
  - B. Image Processing

The artificial process like changing or adding images automatically generated from BIM software is not allowed. The additions are allowed to be added just in the situation that the size and location of building factors (roof, floor, wall, door, window etc.) showed in each image of the perspective and external aerial view are not changed.
  - C. Color Utilization

In the contest stage, color of each image from the perspective and external aerial view can be used, usage of other color is not allowed.
  
- (2) . Design Proposal Checking for BIM Data
  - A. Checking Principle

The submitted BIM data can be directly used in the design proposal checking.
  - B. Checking Method

The principle of design proposal checking is to check the IFC file, if necessary, the original data can be checked.

### 4.3.2 BIM Utilization Standard: Basic Design Quality Assurance Utilization

- (1) . Spatial Design Quality Assurance
  - A. Sufficiency of Area Requirement

The area of spatial object should be sufficient for the "Space Program Code List" supplied in the public announcement stage, the tolerance of each area for the actual name unit should be within  $\pm 10\%$ , and the total tolerance of each region unit actual area should be within  $\pm 5\%$ .
  - B. Sufficiency of Spatial key Requirement

If the spatial key requirement exists, it should be sufficient. (Example: configuration of special rooms, minimum height, proximity of two rooms etc.)
  - C. Sufficiency of Design Requirement for the Disabled

The design requirement for the disabled should be sufficient. The followings are the objects that should be sufficient.

    - Accessibility of the wheel chair for the disabled.
    - Ramp gradient
  - D. Sufficiency of Design Requirement for Refuge and Disaster Prevention

The design requirement for Refuge and disaster prevention should be sufficient. The followings are the objects that should be sufficient.

    - The assurance of the appropriate path connected to each space refuge area.
    - Sufficiency of the stair window, stair width, depth etc. according to the direct access stair, refuge stair and special refuge stair design principles.

#### 4.4 Requirements for BIM Application: Production of Basic Quantity Takeoff

(1) . Basic Quantity Data Takeoff Object

The basic quantity data should be taken off and utilized that can be referred for general estimation, the generation object shows as follows.

Architecture: Open area, door, window

Structure: Reinforce concrete component (groundwork, column, beam, slab, other)

(2) . Basic Quantity Data Takeoff Method

Basic quantity data Takeoff should be generated in the situation that the specific property like component name, size etc. are all input, the specific component should be generated according to each excel type, save and submitted as “basic quantity data.xls”.

(3) . Basic Quantity Data Takeoff Principle

The quantity Takeoff contents generated from the interior BIM software should be consistent with excel contents generated outside based on BIM software.

#### 4.5 Requirements for BIM Application: Production of Project Deliverables

(1) . Principle of Design Drawing Generation

A. BIM Data Generation and Utilization

Drawing (including the drawing contents showed in the layouts) should be generated and utilized within the BIM data imported standard range.

B. Drawing Arbitrary Change Prohibition

Building key factors generated from BIM data should be used accordingly, arbitrary change is prohibited.

C. Allowance of Drawing Addition

Drawing generated from BIM data about characters, guides, furniture etc. can be added according to requirements.

D. Principle of Output cannot be replaced by BIM Data Design Document

Whole or part of the output should not be replaced by the necessary design documents according to the procedure of BIM data deliverables and approval.

(2) . Drawing Output Generation Standard

A. Minimum Application Object Drawing

Field	Minimum Application Object Drawing
Architecture	- Basic drawing (Plan, elevation, section drawing) - Detailed drawing related to vertical, horizontal road line (core detailed drawing, stair detailed drawing, elevator/shaft detailed drawing, parking ramp detailed drawing, parking report detailed drawing)
Structure	- Basic drawing (Plan, elevation drawing) - Detailed drawing (Plan detailed drawing, section detailed drawing)
Mechanical Equipment	- Basic Plan



Electric Equipment	- Basic Plan
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B. Design Drawing Generation Notice

Division	Notice
Aerial View, Integrated Configuration Diagram	- Landscape (including trees) and roads, parking area addition is possible
External Perspective	- Landscape (excluding trees) and roads, parking area addition is possible
Plan, Elevation, Section Drawings	- Do not draw the landscape and road, parking area outside buildings - Internal perspective can be showed (black and white images which are automatically generated from BIM data generation tools)
Building Introduction, Area Table of Each Building, Each Floor Etc.	- Area documents are made according to the data generated from the spatial model data.
Other Drawings	- Color image of aerial view and perspective view can be used - The contents outside buildings can be added black and white for the 2D drawing key requirement
Design Specification	- Color image of layout aerial view and perspective view can be used - Area documents are made according to the data generated from the spatial model data. - The contents outside buildings can be added black and white for the 2D drawing key requirement

C. Application of Drawing Generation Standard

If there is drawing generation standard applied in other field exists, it should be used.

D. Additional Making after Drawing Factor Generation

If the drawings generated from BIM model data are not the final drawings, 2D drawing factor should be added and completed, 이 때 도면데이터는 가급적 레이어등을 사용하여 추가내용의 범위 구분이 가능하도록 구성한다.

E. Insertion of 3D Expression

If necessary, 3D white and black image automatically generated from BIM tools can be inserted for helping the understanding of building part in drawing.

4.6 Requirements for BIM Application: Preliminary Examination of Energy Efficiency

(1) . Preliminary Examination of Energy Efficiency Implementation

- A. The applicants should carry out the Preliminary Examination of Energy Efficiency and add into "BIM Result Report" for submission. (Later the Open BIM standard data submitted by the applicant should be utilized and the PPS can do energy evaluation directly)
- B. The scope of the Preliminary Examination of Energy Efficiency is the thermal load based on Heat Gain and Heat Loss of the building envelope.

- (2) . Preliminary Examination of Energy Efficiency Method
  - A. The energy analysis should use Energyplus or DOE-2 based software. At this time, the minimum range of the BIM data application is the utilization of building geometric information.
  - B. The shape, direction, ratio of the window area in the building model data are referred as the evidence.
  - C. The function and equipment system of some special buildings are not reflected.
  - D. Import standard of climate data will be noticed separately.
  - E. Import standard about wall, door and window will be public announced specially.
  
- (3) . BIM Data Requirement Confirmation for Preliminary Examination of Energy Efficiency
  - A. The building envelope which direct face to the outside air (external wall and the door, window, roof affiliated in the external wall) and the key object of each bottom slab should not be omitted.
  - B. Building envelope model should be consistent with the building model envelope.
  - C. Building envelope model should include the spatial data.

#### 4.7 Requirements for BIM applied Reports

##### 4.7.1 Generation of BIM Result Report

###### (1) . Generation of BIM Result Report

When the applicants are submitting the deliverables, the BIM result report should be generated and submitted.

###### (2) . Contents of BIM Result Report

The following contents should be included.

- Application environment: BIM business application environment
- File deliverable: List of BIM data file
- Product deliverable: list of BIM application product and detailed scope of generation contents
- Special Issues: Special issue took place in the BIM business application process
- BIM data utilization proposal

###### (3) . Contents of “BIM Data Application Proposal” in the Report

Take BIM deliverable contents and standard as the basis, in the later stage, the continuous application method, usage, standard etc. of BIM data will be indicated.

##### 4.7.2 BIM Business Utilization Proposal Generation

###### (1) . BIM Business Application Proposal Generation and Admission

The design qualifier should make and submit the BIM business application proposal.

###### (2) . Contents of BIM Business Utilization Proposal

Writing of BIM business utilization proposal should consider the feature of the business enterprise, and include the following contents.

- Formation of the BIM business execution organization
- Business role of each organization
- Scope of the BIM business execution
- BIM business schedule
- Execution environment: Computer hardware, software, version etc.
- Import object: import professional field
- Import standard: import standard of every field
- Import scope: import object of BIM object and property
- Quality planning: quality assurance object, time, standard, method etc. about BIM data
- Deliverable plan: Objective and contents of final deliverable

(3) . Confirmation of BIM Business Utilization Proposal

BIM Business Utilization Proposal should be regarded as the limited issue for design qualifier.

4.8 Submission Requirements for BIM applied Project Deliverables

4.8.1 Generation Standard of BIM Data File

(1) . Submission Format of BIM Data File

The submission format of BIM data should be the original format and IFC format.

(2) . Submission Object of BIM Data File

Data	Content	Usage
Architectural model of each building	- BIM data including spatial, architectural, structural factors	- Satisfaction evaluation of BIM basic quality key requirement - Visualization checking
Spatial model of each building	- BIM data composed of only spatial object(Only spatial object data generated from architectural model data)	- Satisfaction evaluation of spatial key requirement
Building envelope model of each building	- BIM data composed of only building envelope component and slab between floors in architectural model data - Including spatial object	- Preliminary Examination of Energy Efficiency evidence data
The whole building envelope model and site data	- BIM data including site and whole building envelope supplied by owners - Change of site boundary and the data outside the boundary, boundary coordinate, true north direction is not allowed	- Visualization checking

(3) . Name of BIM Data File

Division	format	Contents	Comments
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Building number	Numeral 2	- Building division - Given by the applicants arbitrarily - 00: individual building or the whole integration - 01: The first building - 02: The second building	- Necessity
Building name	Arbitrary character	- Begin with "_(underscore) - Individual building: "building" - Multiple building: building name - Whole building: "Whole"	- Necessity
Model division	Character 2-3	- Begin with "_(underscore) - BA: Architectural model data - BS: Structural model data - BM: Mechanical model data - BE: Electric model data - S: Spatial model data - E: Building envelope model data	- Necessity
File extension	Character 3	- IFC: standard format - other: original format	- Necessity

Example:

01\_main building\_BA.ifc: main building architectural model data

01\_main building\_S.ifc: main building spatial model data

(4) . Applicant is not allowed to have Implication Contents

The applicant is not allowed to have implication contents directly or indirectly in all BIM data.

#### 4.8.2 Submission Requirements for BIM Deliverable

(1) . Composition of BIM Deliverable

A. The situation that the whole building composes as one

Folder Name	Folder Name	File Name	Comments
BIM	Report	BIM Result Report.hwp BIM Business Execution Proposal.hwp Basic Quantity Data.xls	Hangel 2003 or revised version MS Office 2003 or revised version
	IFC	Architectural model 00_building_BA.ifc (architecture) 00_building_BS.ifc (structure) 00_building_BM.ifc (machine) 00_building_BE.ifc (electricity)	IFC 2x3 or revised version
		Spatial model	

		Building envelope model	00_building_E.ifc 00_whole.ifc (building envelope + site)	
	Original	Architectural model	Consistent with the IFC folder	Original format
		Spatial model	Consistent with the IFC folder	
		Building envelope model	Consistent with the IFC folder	

B. The situation that the building composes of more than two

Folder Name	Folder Name	File Name	Comments	
	Report	BIM Result Report.hwp BIM Business Execution Proposal.hwp Basic Quantity Data.xls	Hangel 2003 or revised version MS Office 2003 or revised version	
BIM	IFC	Architectural model	01_main building_BA.ifc (architecture) 01_main building_BS.ifc (structure) 01_main building_BM.ifc (machine) 01_main building_BE.ifc (electricity) 02_other building_BA.ifc (architecture) 02_other building_BS.ifc (structure) 02...	IFC 2x3 or revised version
		Spatial model	01_main building_S.ifc 02_other building_S.ifc 03...	
		Building Envelope model	01_main building_E.ifc 02_other building_E.ifc 03... 00_whole.ifc (building envelope + site)	
	Original	Architectural model	Consistent with the IFC folder	Original format
		Spatial model	Consistent with the IFC folder	

		Building Envelope model	Consistent with the IFC folder	
--	--	-------------------------	--------------------------------	--

(2) . BIM Deliverable Submission

The media and format of BIM deliverable submission should be based on the Submission Requirements for BIM applied Project Deliverables of PPS.

(3) . Submission Requirements for BIM Deliverables

A. Virus Check

The deliverable data file should be submitted without any virus.

B. Elimination of Unnecessary Information

Some unnecessary information should be eliminated from the deliverable data file, and the file size should be the minimum.

C. Composition of BIM Data Deliverable

The composition of BIM data deliverable should follow the Delivery Guide in this Guide. If the original BIM data file would be submitted, the necessary related files should also be included and submitted.

D. Uncompression of IFC File

The principle is to submit the IFC files uncompressed. If the file size is larger than 300MB, the file could be compressed with zip format and submitted.

E. Uncompression of Original File

Original BIM data file should be submitted uncompressed.

#### 4.9 Duty and Responsibility

(1) . Priority of Design Drawing and BIM data

Design drawing has the priority when there is inconsistency between design drawing and BIM data.

(2) . Responsibility of Design Drawing and BIM Data

In the event that the design drawing that has to be generated and used from BIM data, the applicants should take responsibility for the confirmation of design drawing contents.

(3) . Responsibility of IFC File Conversion

The applicants should take responsibility for the confirmation that the original files were properly converted to IFC files. The method to confirm the result shows as follows.

A. Confirm that the BIM data generated by software can be read again in the same software

B. Confirm by free public IFC file viewer

a) Free public IFC file viewer list introduction site:  
[http://www.ifcwiki.org/index.php/Free\\_Software](http://www.ifcwiki.org/index.php/Free_Software)

b) IfcStoreyView:  
<http://www.iai.fzk.de/www-extern/index.php?id=1134&L=1>

c) DDS-CAD Viewer:

<http://dds.no/ax10x0.xhtml>

- d) SolibriModelViewer:  
<http://www.solibri.com/solibri-model-viewer.html>
- e) PDF Viewer:  
<http://www.adobe.com>

C. Confirm by other IFC file checking program

(4) . BIM Data Utilization Management when Qualified

After the qualification, the qualifier should abide the BIM data utilization management requirements of the PPS.

4.10 Checklists for the BIM Evaluation

(1) . Principle of BIM Evaluation Reflection

The evaluation of BIM data submitted by applicants should reflect the deduction requirements.

(2) . BIM Evaluation Object and Deduction Standard

The object of BIM deduction evaluation shows as follows. (the contents in the table is for example)

Evaluation Object	Deduction Standard (Example)
Violation of Quality Verification Application Standard	Each 0.02 point, maximum X points
Violation of Design Quality Assurance Utilization Standard	Each 0.02 point, maximum X points
Violation of Basic Quantity Data Takeoff Standard	Each 0.02 point, maximum X points
Violation of Design Drawing Generation Standard	Each 0.02 point, maximum X points
Violation of Deliverable Submission Standard	Each 0.01 point, maximum X points
Violation of Requirements for BIM applied Reports	Each 0.01 point, maximum X points
Total	Maximum X points

## 5. BIM applied Batch Bidding System Guidelines in Construction Document (Construction Document Nominator)

### 5.1 Outline

#### (1) . Purpose of BIM Application

The purpose of BIM application in design application phase is to enhance the design quality with minimum quality issues and ensure the accurate construction document to boost eco-friendly design.

#### (2) . Object of BIM Application

The object of BIM Application includes all of the design buildings which decide according to the deliberation with the supervisor.

The object of BIM Application includes the building and site. The buildings of less than 300m<sup>2</sup> (such as gatehouse, parts warehouse and designated the building as a PPS in order) are excluded from the application.

#### (3) . Scope of BIM Data Import

The BIM application scope in design phase includes the objects from space, architecture, structure and MEP (Mechanic and electrical equipment) field, and the objects from civil and landscape filed which decide according to the deliberation with the supervisor.

#### (4) . Goals and Level of BIM Utilization

Goals	Level of Detail
Design Review and Design Quality Assurance	- Space requirement satisfaction assurance - Design requirement satisfaction assurance - Eliminate the construction clash.
basic Quantity Data Takeoff	Basic quantity basic data takeoff from bidding estimation
BIM Drawings Generation	- generate accurate design drawings
Energy Efficiency Verification	- outline the energy efficiency of building envelope performance simulation

### 5.2 Requirements for BIM Data Preparation

#### 5.2.1 Overview of BIM data

##### (1) . Principle of Open BIM

Open BIM technology should be applied within the deliberated scope of deliverable submission. It is for the verification and management of BIM data standardization in construction phase after design phase.

##### (2) . BIM Data Submission Format

BIM data is submitted over the IFC 2x3 standard formats or the original format.

##### (3) . The Choice of BIM Software

C. BIM data generated software to support the IFC 2x3 or instructed software with



the capability of performing work.

- D. Energy analysis software, international standards (IFC 2x3 more or gbXML) by the minimum building geometry information can be linked to the software.

5.2.2 Creating a Common Database

(1) . Establishment of BIM Data Object Input

B. Utilization of basic Design BIM Data

The basic design BIM data should be reused in the design application phase.

C. Target of Import Object

The target of BIM data input is based on the deliberation with the supervisor, including in the following elements

Field	Component Input Object
Structure	- Reinforced concrete: groundwork, column, beam, wall object(internal force wall), bottom(slab), roof, stair, ramp - Rebar: beam, column, truss
Architecture	- Wall object(non-internal force wall), secondary wall object (partition etc.), door, window, shutter, curtain wall, railing etc., patio, roof, secondary structure - The finishing thicker than 50mm
Machine	- Piping, main equipment in mechanic room, fire extinguisher, cabinet pane, water tank
Electricity	Main equipment for electrical wire connection (tray etc.), main equipment for transformer room, lighting equipment
Civil	- Main facility equipment like site, road, breast wall
Landscape	- Landscape facilities, main facilities like pavement - Except planting and trees

D. Principle of BIM Object Division

BIM objects are created by the type of elements separately. (e.g. columns and beams cannot be created by the same object, but to input the objects separately.)

(2) . Creating the Object by Type

C. Input the Object in BIM Software by Type

BIM objects should be created in the BIM software by the related BIM software feature type in principle. (e.g. the column must be created by using the column function in BIM software.)

D. Treatment for the Constrain

If the BIM object is constrained by the BIM software to input, the generic object will be used by the propertied definition.

(3) . Scale and Units

E. Scale

BIM data representation of the detailed drawings is based on the level of 1 / 200 to the outside.

F. Application of Level of Detail

The level of detail is equally applicable to the entire building. However, if necessary to apply different levels of detail and information in part, it should be recorded in the "BIM Final Report".

G. Unit

BIM data is used in millimeters (mm) units in principle.

H. Actual Dimension Compliance

The dimensions differences between the building and the actual element are not adjustable.

(4) . Standard of Story Input

D. Principle of the Story Unit

The building is based on the number of the story as the principle unit.

E. Principle of the Story

The distinction to the objects in the building floor area is from the upper floor slab to the bottom of the slab of the story in principle; a basement floor slab and the foundation of the independent story are separated.

F. Objects Shared among Multiple Stories

If the object spans multiple stories, it will be broken down by story for one unit type. If it's difficult to distinguish, it will be in the lower story.

(5) . Building Configuration File

C. File Organization

BIM data file is configured into one file by the independent building for submission in principle. If two or more buildings are connected, the BIM data file is configured to a single file for submission.

D. Separation of Specific Building Files

You can submit a separate file according to the size and complexity of the building. If necessary, you should breakdown the file.

(6) . Site and Reference Point

F. Site

The 3-D surface of the site is expressed as the relative direction of the north.

G. Temporary Bench Mark of Site

The site coordinate refer to the latitude and longitude of GIS and TM coordinates of the temporary bench mark of site.

The sample format is showed as following,

- Latitude and longitude: 00 ° 0'00 .00 "N, 000 ° 00'00 .00" E

- TM Coordinates: 00s 000000.00mE, 0000000.00mN

H. Site Coordinates

The site coordinates refer to the temporary bench mark and manage the information based on a relatively flat Cartesian coordinates (X,Y) and the ground level (GL).

I. BIM Model Baseline

BIM model to the baseline score from the appointed interim level of the ground is relatively flat Cartesian coordinates (X, Y) and the ground level (GL) and the direction of

true north (°) angle so that the information is managed

J. Input Standards of Existing Building

Existing buildings is the reference to determine the mass of the building above the level to input.

(7) . IFC Property Standard

BIM data input standard for the IFC property ordered separately depending on the nature of the business are provided by appointed PPS.

5.2.3 Guidelines for Spatial Modeling

A. Outline

The spatial model data should be input only in the situation that it is necessary to change the management in the design application phase from the basic design phase.

B. Modeling Standard

The spatial modeling standard should follow the BIM application guide of bidding construction design.

5.2.4 Guidelines for Building Modeling

(3) . Data Standards for Architectural and Structural Model.

A. Object Input Division

Architectural and structural model should be input separately, if necessary, they can be input as integrity.

B. Including Spatial Object

BIM data should include spatial objects

C. Window

Window object should be under the wall objects. (the wall first, then input the window)

D. Principle of Dimensional Accuracy

The size of the building and the land cannot be adjusted arbitrarily.

E. Envelop Model

The envelope model should be sealed with external objects that outdoor air cannot be through to inside of the building.

F. Property Type of Envelop

BIM data for building envelope should be defined and IFC object property type, "IsExternal" should be set to "True".

(4) . Data Requirements for MEP Model

A. Object Input Division

Mechanical components and electrical components should be input separately.

B. Input of Reservation Space

The equipment or piping which do not set detailed can be input as reservation space

C. Clash Prohibition

The main piping, equipment and reservation space of mechanical and electrical model should be input without clash.

#### 5.2.5 Guidelines for Site Modeling

(1) . Object Input Division

Site, civil, landscape components should be input separately.

(2) . Land outside the boundaries

The important data outside the land boundaries (road, side road, surroundings etc.) which is necessary in the design process should be input.

### 5.3 Requirements for BIM Application: Design Examination and Planned Quality Verification

#### 5.3.1 Quality Verification Application

(1) . Perspective and Aerial View Utilization

A. Image Generation Standard

The image automatically generated from BIM software in all the design drawings can be used. As long as the size and location of building factors (roof, floor, wall, door, window etc.) in each image of the perspective and external aerial view are not changed, addition is allowed to be added.

B. Color Utilization

All the image color can be used.

(2) . Video Making

A. Video Making Principle

The design qualifier can produce and supply video for BIM data utilization and helping the understanding of owners based on the requirements of supervisors.

B. Usage of BIM Building Data

The BIM data used for producing video based on unchanged size and location of all the building factors (roof, floor, wall, door, window etc.), for help understanding, additional expression is possible.

C. Video Specification

Video specification shows as follows:

Format: avi

Time: according to consultation

Resolution: more than 640x480

(3) . Design Proposal Checking for BIM Data

A. Checking Principle

The submitted BIM data can be directly used in the design proposal checking.

B. Checking Method

The principle of design proposal checking is to check the IFC file, if necessary, the original data can be checked.

#### 5.3.2 BIM Utilization Standard: Basic Design Quality Assurance Utilization

- (1) . Spatial Design Quality Assurance
  - A. Sufficiency of Area Requirement

The area of spatial object should be sufficient for the “Space Program Code List” supplied in the public announcement stage, the tolerance of each area for the actual name unit and the total tolerance of each region unit actual area should discuss with the supervisors.
  - B. Sufficiency of Spatial key Requirement

If the spatial key requirement exists, it should be sufficient. (e.g.: configuration of special rooms, minimum height, proximity of two rooms etc.)
  - C. Sufficiency of Design Requirement for the Disabled

The design requirement for the disabled should be sufficient. The followings are the objects that should be sufficient.

    - Accessibility of the wheel chair for the disabled.
    - Ramp gradient
  - D. Sufficiency of Design Requirement for Refuge and Disaster Prevention

The design requirement for Refuge and disaster prevention should be sufficient. The followings are the objects that should be sufficient.

    - The assurance of the appropriate path connected to each space refuge area.
    - Sufficiency of the stair window, stair width, depth etc. according to the direct access stair, refuge stair and special refuge stair design principles.
  
- (2) . Design Quality Assurance
  - A. Basic Principle of Design Quality Assurance

The purpose is the sufficiency of BIM utilization standards like design verification, quantity takeoff, design drawing generation, energy efficiency verification etc. for design application, the detailed scope and level of quantity assurance can be decided by the deliberation with supervisors according to the business character.
  - B. Clash Prohibition between Components

There should be no clash between the main architectural components and equipment components. The main architectural components mean groundwork, column, beam, slab, wall, roof, stair, ceiling, door, window, and the main equipment components include each kind of piping, electrical equipment. The clash between these components is not allowed, and the tolerance for other component is within 10mm.
  - C. Support between Structural Components

The column, beam, slab, structural components should support other structural components.
  - D. Verification Method for Clash Detection

In the design application phase should deliberate with supervisors and includes in “BIM business application proposal”.

#### 5.4 Requirements for BIM Application: Production of Basic Quantity Takeoff

- (1) . Object of Basic Quantity Data Takeoff

The basic quantity data should be taken off and utilized that can be referred for general estimation, the generation object shows as follows.

Architecture: brick wall, opening, door, window  
 Structure: Reinforce concrete components (groundwork, column, beam, slab, other)  
 Mechanic equipment: air conditioning equipment, sanitary system, firefighting equipment lists  
 Electrical Equipment: transformation equipment, electrical distribution equipment, communication equipment list

(2) . Contents of Basic Quantity Data Takeoff

Component name, specification, number, size (information like length, height, width, area, volume etc.), floor location etc. should be generated, the detailed generation contents should discuss with the supervisors and includes in the “BIM business application proposal”

(3) . Method of Basic Quantity Data Takeoff

Basic quantity data Takeoff should be generated in the situation that the specific property like component name, size etc. are all input, the specific component should be generated according to each excel type, save and submitted as “basic quantity data.xls”.

(4) . Principle of Basic Quantity Data Takeoff

The quantity Takeoff contents generated from the interior BIM software should be consistent with excel contents generated outside based on BIM software.

5.5 BIM Utilization Standard: BIM Design Documents Generation

(1) . Principle of Design Drawing Generation

A. Principle of BIM Data Generation and Utilization

Drawings should be generated and utilized within the BIM data imported standard range.

B. Drawing Arbitrary Change Prohibition

Building key factors generated from BIM data should be used accordingly, arbitrary change is prohibited.

C. Allowance of Drawing Addition

Drawing generated from BIM data about characters, guides, furniture etc. can be added according to requirements.

D. Principle of Output cannot be Replaced by BIM Data Design Document

Whole or part of the output should not be replaced by the necessary design documents according to the procedure of BIM data deliverables and approval.

(2) . Drawing Generation Object and Standard

A. Least Application Object Drawing

1/50 expression of the design drawing should be the object and the basic drawings show as follows:

Field	Minimum Application Object Drawing
Architecture	- Basic drawing (Plan, elevation, section drawing) - Detailed drawing related to vertical, horizontal road line (core detailed drawing, stair detailed drawing,

	elevator/shaft detailed drawing, parking ramp detailed drawing, parking report detailed drawing)
Structure	- Plan, elevation drawing) - Detailed plan drawing, detailed section drawing)
Mechanical Equipment	- General chart, plan, system map(level at expression of main equipment), detailed map
Electric Equipment	- General chart, plan, system map (level at expression of main equipment), detailed map

B. Application of Drawing Generation Standard

If there is drawing generation standard applied in other field exists, it should be used.

C. Additional Making after Drawing Factor Generation

If the drawings generated from BIM model data are not the final drawings, 2D drawing factor should be added and completed, 이 때 도면데이터는 가급적 레이어등을 사용하여 추가내용의 범위 구분이 가능하도록 구성한다.

D. Insertion of 3D Expression

If necessary, 3D white and black image automatically generated from BIM tools can be inserted for helping the understanding of building part in drawing.

## 5.6 Requirements for BIM Application: Examination of Energy Efficiency

### (1) . Outline

A. Basic Issues

Energy efficiency verification is to analysis the building energy, use the simulation tool (the simulation tool possible for one year, 8760hours), and generate the necessary information for BIM energy simulation.

B. In this business, load analysis is carried out by energy simulation for energy efficiency verification utilization.

C. The energy analysis should use Energyplus or DOE-2 based software. The detailed version of the software should deliberate with the owners.

### (2) . Application Method for Energy Analysis

A. The minimum scope of BIM data application is the building geometric information application, the information which does not include in the BIM data should be made separately and applied. At this time, the detailed proposal should be based on the deliberation.

B. Building location information: latitude, longitude, elevation etc.

C. Building 3D geometric information

D. Building envelop information (window, wall, floor, roof): necessary material for calculation of heat transformation by envelope (transformation, exchange) can be applied.

E. Thermal Zones: information about energy analysis can be applied. One room can be set for one thermal zone, and one room can also be set for many zones. Several rooms with the same load pattern can be set in one thermal zone.

F. Internal heat factors: the following information about the internal heat factors of

defined each thermal zone (human, lighting, machine) can be utilized. For human factor, the information like schedule, number of people, activities (business, class, sport etc.). For lighting, the lighting machine type and gas volume, the relation with return air, the information related to lighting schedule. For machine, schedule and gas volume related information can be utilized.

- G. Building usage profiles: the setting temperature of each thermal zone (every season, week/night, every hour), the information related to building operation schedule can be utilized.
- H. Ventilation: the outside air volume and ventilation related information can be utilized.

## 5.7 Requirements for BIM applied Reports

### 5.7.1 Generation of BIM Result Report

#### (1) . Generation of BIM Result Report

When the qualifier is submitting the deliverables, the BIM result report should be generated and submitted.

#### (2) . Contents of BIM Result Report

The following contents should be included.

- Application Environment: BIM business application environment
- File Deliverable: List of BIM data file
- Product Deliverable: list of BIM application product and detailed scope of generation contents
- Special Issues: Special issue took place in the BIM business application process
- BIM data utilization proposal

#### (3) . Contents of “BIM Data Application Proposal” in the Report

Take BIM deliverable contents and standard as the basis, in the construction stage, the continuous application method, usage, standard etc. of BIM data will be indicated.

## 5.8 Submission Requirements for BIM applied Project Deliverables

### 5.8.1 Generation Requirements for BIM Data File

#### (1) . Submission Format of BIM Data File

The submission format of BIM data should be the original format and IFC format or the revised format.

#### (2) . Submission Object of BIM Data File

Data	Content	Usage
Architectural model of each building	- BIM data including spatial, architectural, structural factors	- Satisfaction evaluation of BIM basic quality key requirement - Visualization checking
Spatial model of each building	- BIM data composed of only spatial object(Only spatial object data generated from architectural model	- Satisfaction evaluation of spatial key requirement



	data)	
Building envelope model of each building	- BIM data composed of only building envelope component and slab between floors in architectural model data - Including spatial object	- Preliminary Examination of Energy Efficiency evidence data
The whole building envelope model and site data	- BIM data including site and whole building envelope supplied by owners - Change of site boundary and the data outside the boundary, boundary coordinate, true north direction is not allowed	- Visualization checking

(3) . Name of BIM Data File

Division	format	Contents	Comments
Building number	Numerical 2	- Building division - Given by the applicants arbitrarily - 00: individual building or the whole integration - 01: The first building - 02: The second building	- Necessity
Building name	Arbitrary character	- Begin with "_" (underscore) - Individual building: "building" - Multiple building: building name - Whole building: "Whole"	- Necessity
Model division	Character 2-3	- Begin with "_" (underscore) - BA: Architectural model data - BS: Structural model data - BM: Mechanical model data - BE: Electric model data - S: Spatial model data - E: Building envelope model data	- Necessity
File extension	Character 3	- ifc: standard format - other: original format	- Necessity

Example:

01\_main building\_BA.ifc: main building architectural model data

01\_main building\_S.ifc: main building spatial model data

5.8.2 Submission Requirements for BIM Deliverable

(1) . Composition of BIM Deliverable

A. The situation that the whole building composes as one

Folder Name	Folder Name	File Name	Comments
BIM	Report	BIM Result Report.hwp BIM Business Execution Proposal.hwp	Hangel 2003 or revised version MS Office 2003 or

			Basic Quantity Data.xls	revised version
	IFC	Architectural model	00_building_BA.ifc (architecture) 00_building_BS.ifc (structure) 00_building_BM.ifc (machine) 00_building_BE.ifc (electricity)	IFC 2x3 or revised version
		Spatial model	00_building_S.ifc	
		Building envelope model	00_building_E.ifc 00_whole.ifc (building envelope + site)	
	Original	Architectural model	Consistent with the IFC folder	Original format
		Spatial model	Consistent with the IFC folder	
Building envelope model		Consistent with the IFC folder		

B. The situation that the building composes of more than two

Folder Name	Folder Name	File Name	Comments
BIM	Report	BIM Result Report.hwp BIM Business Execution Proposal.hwp Basic Quantity Data.xls	Hangel 2003 or revised version MS Office 2003 or revised version
	IFC	Architectural model	01_main building_BA.ifc (architecture) 01_main building_BS.ifc (structure) 01_main building_BM.ifc (machine) 01_main building_BE.ifc (electricity) 02_other building_BA.ifc (architecture) 02_other building_BS.ifc (structure) 02...
		Spatial model	

			03...	
		Building Envelope model	01_main building_E.ifc 02_other building_E.ifc 03... 00_whole.ifc (building envelope + site)	
	Original	Architectural model	Consistent with the IFC folder	Original format
		Spatial model	Consistent with the IFC folder	
Building Envelope model	Consistent with the IFC folder			

(2) . BIM Deliverable Submission

The media and format of BIM deliverable submission should be based on the Submission Requirements for BIM applied Project Deliverables of the PPS.

(3) . Submission Requirements for BIM Deliverables

A. Virus Check

The deliverable data file should be submitted without any virus.

B. Elimination of Unnecessary Information

Some unnecessary information should be eliminated from the deliverable data file, the file size should be the minimum.

C. Composition of BIM Data Deliverable

The composition of BIM data deliverable should follow the Delivery Guide in this Guide. If the original BIM data file would be submitted, the necessary related files should also be included and submitted.

D. Uncompression of IFC File

The principle is to submit the IFC files uncompressed. If the file size is larger than 300MB, the file could be compressed with zip format and submitted.

E. Uncompression of Original File

Original BIM data file should be submitted uncompressed.

5.9 Duty and Responsibility

(1) . Priority of Design Drawing and BIM data

Design drawing has the priority when there is inconsistency between design drawing and BIM data.

(2) . Responsibility of Design Drawing and BIM Data

In the event that the design drawing that has to be generated and used from BIM data, the applicants should take responsibility for the confirmation of design drawing contents.

(3) . Responsibility of IFC File Conversion

The applicants should take responsibility for the confirmation that the original files were properly converted to IFC files. The method to confirm the result shows as follows.

- D. Confirm that the BIM data generated by software can be read again in the same software
- E. Confirm by free public IFC file viewer
  - f) Free public IFC file viewer list introduction site:  
[http://www.ifcwiki.org/index.php/Free\\_Software](http://www.ifcwiki.org/index.php/Free_Software)
  - g) IfcStoreyView:  
<http://www.iai.fzk.de/www-extern/index.php?id=1134&L=1>
  - h) DDS-CAD Viewer:  
<http://dds.no/ax10x0.xhtml>
  - i) SolibriModelViewer:  
<http://www.solibri.com/solibri-model-viewer.html>
  - j) PDF Viewer:  
<http://www.adobe.com>
- F. Confirm by other IFC file checking program

(4) . BIM Data Utilization Management of PPS

After the qualification, the utilization management of BIM data should be included in the contract requirements and agreed by the qualifier.

## 6 Guidelines for BIM Application on Construction Phase (Contractor)

### (1) . Purpose and Object of BIM Utilization

The purpose and object of BIM utilization show as follows

Utilization Purpose	Object
Construction Verification	- Eliminate the clash between different types of work in advance
Project Management	- Connect to BIM requirements of project management at site
Construction Cost Management	- predict and manage accurate construction cost
Construction Design Drawing Generation	- Site drawing generation
Quality Management at Site	- Safety management, site education etc.

### (2) . Scope and Level of BIM Utilization

The detailed scope and level of BIM utilization is included in the bidders' Proposal.