



BRICS
2022 CHINA

2022 BRICS Skills Competition

(BRICS Future Skills Challenge)



TECHNICAL DESCRIPTION

Building Information Modeling (Offline)

Catalogue

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1. Introduction

1.1 Name and description of the skill competition

1.1.1 Name of the skill competition

Building Information Modeling (BIM)

1.1.2 Description of the associated work role(s) or occupation(s)

For the Building Information Modeling (BIM) event of the 2022 BRICS Skills Competition, contestants need to complete the given task by computer. Building Information Modeling (BIM) offline competition is an individual skill competition involving a single contestant.

Building Information Modelling (BIM) is a process for creating and managing information on a construction project across the project lifecycle. One of the key outputs of this process is the Building Information Model, the digital description of every aspect of the built asset. This model draws on information assembled collaboratively and updated at key stages of a project. Creating a digital Building Information Model enables those who interact with the building to optimize their actions, resulting in a greater whole life value for the asset.

The competition focuses on the required knowledge and skills that practitioners in the building information modelling industry should possess. Participants should have the skills to create and edit 3D digital models of projects using computer and BIM technology in the common data environment, be familiar with and be able to apply relevant national and international BIM standards, create digital models of buildings and structures according to employer requirements, coordinate and correct models, visualize them, and can be displayed by 3D printing. The skills include the skills in organization and management, use of computer hardware and software, interpretation of customer requirements, architectural and structural modeling, model coordination, model correction, model output, and visualization.

1.2 Relevance and significance of this document

This document contains information about the standards required to compete in this skill competition, and the assessment principles, methods and procedures that govern the competition.

Every Expert and Competitor must know and understand this Technical Description.

If there is any conflict between the technical instructions in the different languages, the English version shall prevail.

1.3 Registration qualification

Teachers and students from vocational colleges (including technical colleges) aged 16-35 can participate as contestants.

2. Skills standard

2.1 General Notes

The BRICS2022SS determines the knowledge, understanding and specific skills that underpin best practices of technical and occasional work performance levels for professionals among these counties. It should reflect a shared global understanding of the associated work roles or occupations that represent industry and business.

This standards specification is a guide to the required training and preparation for the skill competition.

In the skill competition the assessment of knowledge and understanding will take place through the assessment of performance. There will only be separate tests of knowledge and understanding where there is an overwhelming reason for these.

The Standard is divided into distinct sections with headings and reference numbers added. Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards. This is often referred to as the “weighting”. The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

Through the Test Project, the Marking Scheme will assess only those skills that are set out in the Standards Specification. They will reflect the Standards as comprehensively as possible within the constraints of the skill competition.

The Marking Scheme will follow the allocation of marks within the Standards to the extent practically possible. A variation of up to five percent is allowed, provided that this does not distort the weightings assigned by the Standards.

2.2 Skill Standards

part		relative materiality (%)
1	Work organization and project setup	5

	<p>Players need to understand and understand:</p> <ul style="list-style-type: none"> – The various purposes and uses for BIM Modelling – Standards currently used and recognised by industry (ISO 19650-1 and 19650-2) <ul style="list-style-type: none"> – Health and safety legislation and best practice including specific safety precautions when using a visual display unit (VDU) and in a workstation environment – Technical terminology and symbols – Recognised IT systems and related professional design software – The correlation between the purpose of the information and level of detail needed to communicate design intent with accuracy and clarity, referring to the Levels of Detail (LODs). <ul style="list-style-type: none"> – The importance of effective communications and inter-personal skills between co-workers, clients and other related professionals – The importance of maintaining knowledge and skill in new and developing technologies – The role of providing innovative and creative solutions to technical and design problems and challenges – The importance of working to the deliverables and deadlines of the BEP (BIM execution plan) – The importance of working to the client brief. 	
	<p>Players should be able to:</p> <ul style="list-style-type: none"> – Apply the internationally recognised standards and standards currently used and recognised by industry – Apply and promote health and safety legislation and best practice in the workplace <ul style="list-style-type: none"> – Access and recognise standard component and symbol libraries – Use and interpret technical terminology and symbols used in preparing and presenting Information Models, Structural and Architectural drawings <ul style="list-style-type: none"> – Use recognized IT systems and related professional design software to consistently produce high quality designs and interpretations – Deal with co-ordination problems such as alerts received due to shared elements that have been modified – Produce work that consistently meets high standards of accuracy and clarity in the design and presentation of designs and Model information to potential users – Use effective communications and inter-personal skills with and between co-workers, clients, and other related professionals to ensure that the BIM model process meets requirements of the BEP – Describe to clients and other professionals the role and purposes of 	

	<p>BIM</p> <ul style="list-style-type: none"> – Explain complex technical images to experts and non-experts, highlighting key elements – Maintain proactive continuous professional development in order to maintain current knowledge and skill in new and developing technologies and practices – Provide and apply innovative and creative solutions to technical and design problems and challenges – Provide a range of visualisations of the desired project in order to fulfil the client's brief accurately – Output and display BIM model with 3D printer 	
2	Software and hardware	5
	<p>Players need to understand and understand:</p> <ul style="list-style-type: none"> – Computer operating systems to be able to use and manage computer files and software correctly – Peripheral devices used in the digital construction process – Specific specialist technical operations within design software – The workflow for digital construction projects – The limitations of the design software – Formats and resolutions 	
	<p>Players should be able to:</p> <ul style="list-style-type: none"> – Power up the equipment and activate the appropriate modelling software – Set up and check peripheral devices such as keyboard, and mouse – Use computer operating systems and specialist software to create and manage and store files proficiently both locally and to the Common Data environment BIM project – Select correct drawing packages from an on-screen menu or graphical equivalent – Use various techniques for accessing and using BIM software and 3D printing software such as a mouse, menu, or tool bar – Configure the parameters of the software – Start the 3D printer and set up the printer parameters 	
3	Interpretation of the client brief	10
	<p>Players need to understand and understand:</p> <ul style="list-style-type: none"> – What information is provided in a client's brief – The importance of the Exchange Information Requirements (EIR) – The importance of the Asset Information Requirements (AIR) of 	

	<p>the project</p> <ul style="list-style-type: none"> – The relevant and current industry standards – How to work from a BIM Execution Plan (BEP) from the EIR – How to create and edit BIM information within a Common Data Environment (CDE) across the lifecycle of construction. – The importance of file structures and sharing protocols within the CDE 	
	<p>Players should be able to:</p> <ul style="list-style-type: none"> – Interpret clients' briefs to determine: Outline requirements of each project Client goals Locations – Work from BEPs and client Briefs and EIR to address client and project requirements 	
4	BIM modeling	50
	<p>Players need to understand and understand:</p> <ul style="list-style-type: none"> – Programs used in the BIM modelling and collaboration process – Computer operating systems in order to use and manage computer files and <ul style="list-style-type: none"> – software – The importance of organising BIM objects into meaningful groups of disciplinary <ul style="list-style-type: none"> – information that can be managed visually – How to create BIM Models (Structural and Architectural) – Principles of Technical Design – How to access and use documentation in a BIM project – How to set up a BIM model as a collaborative file – How to set up a project location, orientation and level datum – The use of Work in Progress (WIP) folders – The importance of Information exchanges (Data drops) at key project stages and of working to the requirements of the BEP – How to produce a given detail to current standards. – Use 3D visualisation tools 	
	<p>Players should be able to:</p> <ul style="list-style-type: none"> – Open an appropriate Project Information Model from the relevant directory within the CDE – Populate Project Properties with given information – Set each model up as collaborative files – Create work sets 	

	<ul style="list-style-type: none"> - Set each project Location, orientation and level datum - Create each structural grid. - Create BIM models as per given drawings - Save each BIM model with a prescribed starting View - Save each Project Information Model within the CDE for use by the other disciplines via Construction Cloud software <ul style="list-style-type: none"> - Adhere to the requirements of the BEP to ensure Data drops are made via the <ul style="list-style-type: none"> - Construction Cloud software - Produce scaled detailed drawings to the required Standard using callout and details items - Create 3D visuals to illustrate each building form different viewpoints 	
5	Model coordination	10
	<p>Players need to understand and understand:</p> <ul style="list-style-type: none"> - How to Federate different discipline models with the same model format - What a hard clash is and how to use the BEP to ensure requirements/ responsibilities are achieved and perform a Hard clash inspection - How to upload and report hard issues to BIM project and the CDE - How to perform and record details of a Soft Clash inspection 	
	<p>Players should be able to:</p> <ul style="list-style-type: none"> - Federate structural, Architectural and specialist designer project models - Perform Hard Clash Inspections as per the BEP - Export all tests as per the BEP and issue to the CDE - Save and issue federated files as per the BEP - Quality assure each federated project model by "Walk around" each CDE hosted model. <ul style="list-style-type: none"> - Identify issues with coordination in each new build that haven't shown up in the three hard clash tests. For each issue discovered <ul style="list-style-type: none"> Create the issue Add annotation describing the issue Assign the Issue to the BIM Manager on the project - Name each view as per the BEP 	
6	Correcting modeling	5
	<p>Players need to understand and understand:</p>	

	<ul style="list-style-type: none"> - Current Documentation standards to Building Information Modelling - How to populate the Model with structural asset data - Classification information for model elements - How to produce scaled detailed drawings to the required Standard - How to produce a given detail to current standards. 	
	<p>Players should be able to:</p> <ul style="list-style-type: none"> - Update Project Information Models from the published directory - Ensure all required assets have the required data populated as per the latest standard - Add classification information to the model elements - referring to the project BEP - From the now corrected federated project model, produce dimensioned Floor Plan drawings and elevation drawings 	
7	Data extraction and management	5
	<p>Players need to understand and understand:</p> <ul style="list-style-type: none"> - The importance of Data creation and extraction from the digital model for use by stakeholders in the project - How to create a Shared Parameter file for custom data requirements - How to create schedules of project information with customised data fields - How to use filters with parameters to visually express custom data requirements - How to create a visualisation that express' s statutory regulations around fire and or thermal u values or similar. 	
	<p>Players should be able to:</p> <ul style="list-style-type: none"> - Create a Shared Parameter file with custom parameters for selected building elements - Create Custom Tags to visually express technical information from the custom parameters - Create colour filters to visually express technical information from the custom parameters on duplicate plans, sections and 3D cut sections - Create schedules of project information including custom parameters 	
8	visualization	5
	<p>Players need to understand and understand:</p> <ul style="list-style-type: none"> - The importance of being able to produce renderings of a model to a 	

	<p>suitable quality for the client</p> <ul style="list-style-type: none"> – How to produce a fully rendered animation on the model – The use of Composition, background and other components in a visualisation to provide a more realistic representation of the model to the client – How to create a visualisation that demonstrates the effects of solar movement and the time of day on the model 	
	<p>Players should be able to:</p> <ul style="list-style-type: none"> – Using appropriate software, create a highly accurate representation of the federated project Information Model for marketing purposes including animations and VR models – Use of Composition, lighting, background to optimal effect – Consider and determine the placement of entourage and other components from the library. 	
9	Solid model output	5
	<p>Players need to understand and understand:</p> <ul style="list-style-type: none"> – Importance of solid models – File format, IFC file and STL file conversion – BIM 3D printing method – Materials required for 3D printing – How to use 3D printer and set up printer parameters 	
	<p>Players should be able to:</p> <ul style="list-style-type: none"> – Use BIM software to export 3D printing standard format files, and successfully import 3D printing software – Set up model parameters in 3D printing software – Start the 3D printer, set up the parameters of the 3D printer, and load the 3D printing materials – Successfully complete the 3D printing solid model and display it 	

3. Marking scheme

3.1 General Guidance

This section describes the role and place of the Marking Scheme, how the Experts will assess Competitors’ work as demonstrated through the Test Project, and the procedures and requirements for marking.

The Marking Scheme is the pivotal instrument of the BRICS Skills Competition, in that

it ties assessment to the standard that represents each skill competition, which itself represents a global occupation. It is designed to allocate marks for each assessed aspect of performance in accordance with the weightings in the Standards.

By reflecting the weightings in the Standards, the Marking Scheme establishes the parameters for the design of the Test Project. Depending on the nature of the skill competition and its assessment needs, it may initially be appropriate to develop the Marking Scheme in more detail as a guide for Test Project design. Alternatively, initial Test Project design can be based on the outline Marking Scheme. From this point onwards the Marking Scheme and Test Project should be developed together.

Section 2.1 above indicates the extent to which the Marking Scheme and Test Project may diverge from the weightings given in the Standards, if there is no practicable alternative.

For integrity and fairness, the Marking Scheme and Test Project are increasingly designed and developed by one or more independent people with relevant expertise. In these instances, the Marking Scheme and Test Project are unseen by Experts until immediately before the start of the skill competition, or competition module. Where the detailed and final Marking Scheme and Test Project are designed by Experts, they must be approved by the whole Expert group prior to submission for independent validation and quality assurance.

3.2 Marking criteria

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived before, or in conjunction with, the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards; in others they may be different. There will normally be between five and nine Assessment Criteria. Whether or not the headings match, the Marking Scheme as a whole must reflect the weightings in the Standards. Assessment Criteria are created by the person or people developing the Marking Scheme, who are free to define the Criteria that they consider most suited to the assessment and marking of the Test Project. Evaluation criteria, score allocation, and evaluation methods are not listed in this technical description. This is because the Criteria, allocation of marks, and assessment methods all depend on the nature of the Marking Scheme and Test Project, which is decided after this Technical Description is published. The Mark Summary Form will comprise a list of the Assessment Criteria and Sub Criteria.

The marks allocated to each Criterion will be manually calculated. These will be the cumulative sum of marks given to each Aspect within that Assessment Criterion.

3.3 Sub Criteria

Each Assessment Criterion is divided into one or more Sub Criteria. Each Sub Criterion becomes the heading for a BRICS Skills Competition marking form. Each marking form (Sub Criterion) contains Aspects to be assessed and marked by measurement or judgement, or both

measurement and judgement. Each marking form (Sub Criterion) specifies both the day on which it will be marked, and the identity of the marking team.

3.4 Aspects

Each Aspect defines, in detail, a single item to be assessed and marked, together with the marks, and detailed descriptors or instructions as a guide to marking. Each Aspect is assessed either by measurement or by judgement. The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it. The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the Standards.

3.5 Assessment and marking

There is to be one marking team for each Sub Criterion, whether it is assessed and marked by judgement, measurement, or both. The same marking team must assess and mark all Competitors. Where this is impracticable (for example where an action must be done by every Competitor simultaneously, and must be observed doing so), a second tier of assessment and marking will be put in place, with the approval of the Competitions Committee Management Team. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances.

3.6 Assessment and marking using judgement

Judgement uses a scale of 0-3. To apply the scale with rigour and consistency, judgement must be conducted using:

- benchmarks (criteria) for detailed guidance for each Aspect (in words, images, artefacts or separate guidance notes)
- the 0-3 scale to indicate:
 - 0: performance below industry standard
 - 1: performance meets industry standard
 - 2: performance meets and, in specific respects, exceeds industry standard
 - 3: performance wholly exceeds industry standard and is judged as excellent

Three Experts will judge each Aspect, normally simultaneously, and record their scores. A fourth Expert coordinates and supervises the scoring, and checks their validity. They also act as a judge when required to prevent compatriot marking.

3.7 Assessment and marking using measurement

Normally three Experts will be used to assess each aspect, with a fourth Expert

supervising. In some circumstances the team may organize itself as two pairs, for dual marking. Unless otherwise stated, only the maximum mark or zero will be awarded. Where they are used, the benchmarks for awarding partial marks will be clearly defined within the Aspect.

3.8 The use of measurement and judgement

Decisions regarding the choice of criteria and assessment methods will be made during the design of the competition through the Marking Scheme and Test Project.

3.9 Skill Assessment Strategy

This skill competition is classed as “fault finding” on all days, therefore no Expert and Competitor communication during the competition time including breaks and lunch period are allowed. Experts assessing compatriot competitors should be avoided.

3.10 Skill assessment procedures

Assessment and marking are an intense process that depends upon skillful leadership, management, and scrutiny. Mandatory Assessment Training should be in place to ensure practical assessments of each Experts’ expertise both technically, and in assessment and marking. Following this, the Chief Expert will determine who will assess, and who will have the opportunity to enhance their expertise through observation.

Marking teams are based on sub criteria, which in turn will reflect the weightings in the standards defined in section 2.2. The criteria for determining which marking team will mark each sub criteria is in the competition’s assessment plan as well as the organization and timing of each module.

One marking team must mark every Aspect within the sub criterion. Blind marking and compatriot marking should be avoided. The composition of each marking team will ensure that these restrictions are adhered to.

Exceptions to the Rules are permissible only with the agreement of the whole body of the experts.

4. Test project

4.1 Common precautions

Whether it is a single module or a series of separate or associated modules, a test item evaluates the application of knowledge, skills, and behavior as defined in the standard.

Combined with the scoring scheme, the purpose of the test project is to provide

comprehensive, balanced and real opportunities for standard evaluation and scoring. The relationship between test items and scoring schemes and standards will be a key indicator of quality, as is the relationship between standards and actual work performance.

The test items do not include items other than the criteria and do not affect the balance of scores within the criteria.

The evaluation of knowledge and understanding is only through practical application.

4.2 Test the project format / framework

The test project is three separate modules, combined to complete a complete project. Skills that may be tested in different modules may include:

Public data environment;

Project information model;

structural modeling;

Building modeling;

comprehensive chart;

Model coordination;

Model correction;

data fetch;

Animation and photo rendering;

Each module allows for a combination of the above skills, but each module must be tested for different abilities.

4.3 Time allocation and score weight of test items

Module	Duration (min)	Score weight (%)
Module 1: CDE environment setting and structure modeling	210	35
Module 2: Architectural modeling and Solid model output	210	35
Module 3: Model application	210	30

Module	Duration (min)	Score weight (%)
amount to	630	100

4.4 Operation content and requirements of each module

No.	Sub-module	Work Requested
Module 1	CDE	<ol style="list-style-type: none"> 1 Create a folder structure with CDE functionality on the specified local network server 2 Follow BEP and ISO19650-1 / 2 when creating folder
	Item information	<ol style="list-style-type: none"> 1 Complete the project information 2 Create grids and hierarchies
	Structural modeling	<ol style="list-style-type: none"> 1 Create the structural foundations, columns, beams, floors, walls, stairs, and prefabricated structural components from the BEP and the drawings provided. 2 Create a structural model using the drawings provided 3 Make the structural model a model shared with the work
Module 2	Area	<ol style="list-style-type: none"> 1 Create a site model and components on the site
	Architectural modeling	<ol style="list-style-type: none"> 1 Create a building grid and a level 2 Create building walls, floors, and roofs 3 Create doors, Windows, stairs, and railings 4 Set the architecture model as a working-sharing model
	Solid model output	<ol style="list-style-type: none"> 1 Export the building model as a 3D printing format file and output it as a solid model for display. The 3D printing time is not included in the competition time, during which the contestants can return to the competition field to adjust and check the printer status
Module 3	Model coordination	<ol style="list-style-type: none"> 1. A series of checks on the models; 2. Reporting and assigning the problems found;
	Correcting the model	<ol style="list-style-type: none"> 1 Modify the model as required by the BEP
	blueprint	<ol style="list-style-type: none"> 1 Dimensioned floor plan views and section views

		2. Drawings of prefabricated floors, walls, beams, etc. 3 Detailed drawings
	Plan and list	1. List of prefabricated floors, walls, beams, embedded components and steel bars 2. Number of non-prefabricated components.
	visualization	1 Create the room, as appropriate from the BEP 2. Generate photo-rendered images; 3. Make an internal and external animation of a model;

4.5 Release of test questions

The test items will be published via the website.

4.6 Changes of test items

Before the official competition, the test items is changed 30%.

5. Skill management and communication

5.1 The Expert Group

A technical expert group was set up to further revise the technical documents and daily skill management of the remote final.

5.2 Discussion platform

The official documents issued by the event Committee shall prevail

6. Safety requirements

Regulations on COVID-19 prevention work should be strictly followed.

7. Materials and Equipment

7.1 Infrastructure list

The list of infrastructure details all the equipment and facilities to be prepared by the participants, see the "Infrastructure List of the 2022 BRICS Skills Competition".

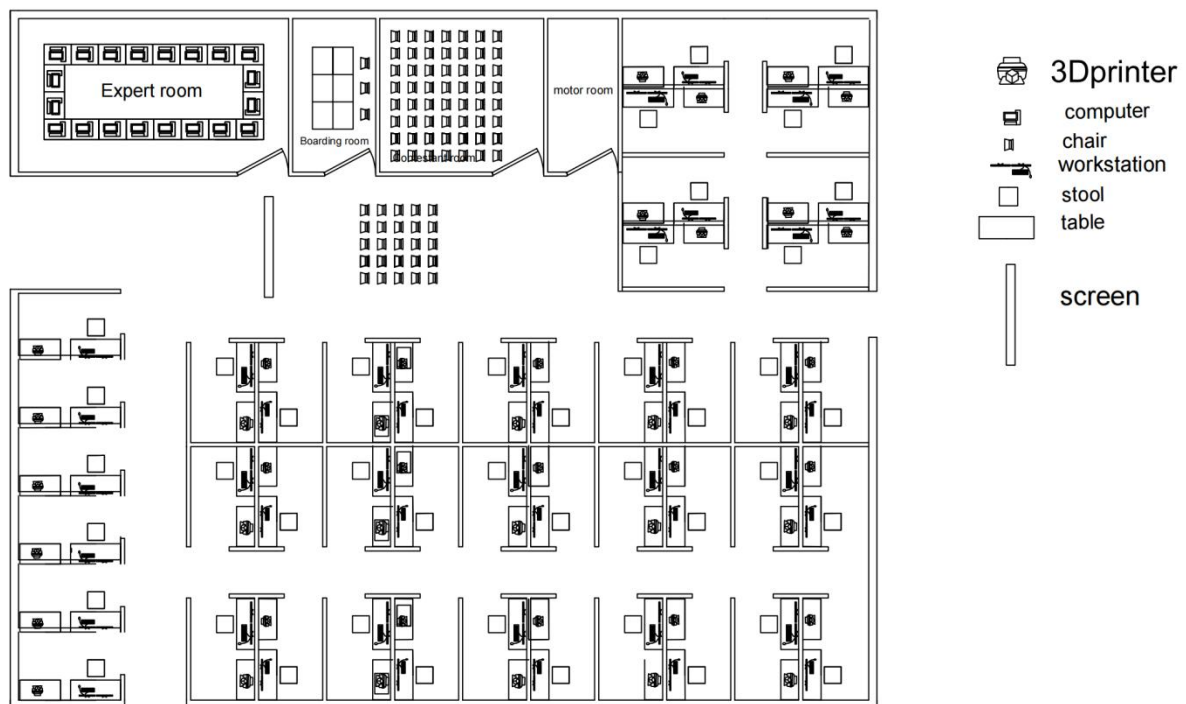
7.2 Materials, equipment and tools brought by the competitors

The necessary materials, equipment, and tools required during the competition will be listed. If contestants need additional materials not listed, all experts need to meet to vote on whether to approve the material requests.

7.3 Materials and equipment prohibited in the skill area

No communication, recording equipment and unauthorized recording equipment into the competition area. Any materials and equipment carried by the participant shall be declared (presented) to the expert. Experts may prohibit the use of any items unrelated to the task or may give an unfair advantage to the contestant.

7.4 Suggested competition area and workstation layout



7.5 Equipment

The following specifies the recommended configuration requirements for the desktop technical specifications

Processor for the Intel I9 Series

2*16G DDR4 2666MHz

512 GB SSD M.2+1TB

NVIDIB QuBdro P2200 5GB 4DP

The network card integrates a gigabit network card

2 * Video device is 24 inches

Necessary accessories

7.6 Software

Windows10 64 Bit, CAD Viewer, Adobe Reader 9, FTP, 3D printing software, Planbar, Bim Competition and much more

8 Skills-specific rules

Skills-specific rules cannot contradict or prioritize the rules of the game. They will provide specific details and clear illustrations of different aspects that vary by skill competition. They include, but are not limited to, personal computing devices, data storage devices, Internet access, work procedures, and document management and distribution.