Building Information Modelling

Technical Description

worldskills

WorldSkills International, by a resolution of the Competitions Committee and in accordance with the Constitution, the Standing Orders, and the Competition Rules, has adopted the following minimum requirements for this skill for the WorldSkills Competition.

The Technical Description consists of the following:

Effective 22.09.2020

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1 Introduction

1.1 Name and description of the skill competition

1.1.1 The name of the skill competition is

Building Information Modelling (BIM)

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

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.

With the new BIM era, the design and construction industry is dealing with an explosion of software technologies made available under the umbrella of "BIM". As a result, approaching the design, engineering and construction of buildings is changing exponentially from design storytelling to engineering calculation and delivery of a finished building. This means that existing professions face different demands, new workflows and new skills in performing the role of a Building Information Modeller.

Collaboration is vital to the success of this role, BIM demands, more than ever, a high level of people-skills in the form of communication, collaboration and proactivity. BIM requires the recruitment of professionals with better people skills. To bring architects, architectural technologists, engineers and contractors together, to combine and enhance their collective output, calls for the complex interplay of technical skills, BIM and communication skills, all of which must be at a professional standard.

Computer aided design is the use of computer systems as a tool to assist in the creation, modification, analysis, and optimization of a BIM model. CAD software is used to increase the productivity of the BIM modeller, improve the quality of design, improve communication through documentation, and create a database for project implementation. The CAD output is often in the form of electronic files for cloud sharing, cloud collaboration, Investigation, manufacturing or other Construction processes. The technical and architectural models and images must convey information such as Project location, building organizing elements, structured data, according to application-specific conventions. CAD is also used to produce computer animation, VR and AR experiences during the whole BIM cycle including advertising and technical manuals.

CAD is an important industrial tool for BIM implementation and is the way construction projects come true. Its process and outputs are essential to successful solutions for construction, engineering and manufacturing problems, with the ability to create a federated model by merging multiple models to allow soft and hard clash detection analysis. CAD software helps us explore ideas, visualize concepts through photorealistic renderings and movies, and simulates how the BIM project will perform in the real world.

New technologies are creating new occupations through enhancement, additions, and alterations. The role of Building Information Modeller is an emerging occupation with exciting implications for future career pathways.

1.1.3 Number of Competitors per team

Building Information Modelling is a single Competitor skill competition.

Age limit of Competitors

The Competitors must not be older than 25 years in the year of the Competition.

1.2 The 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.

In the event of any conflict within the different languages of the Technical Descriptions, the English version takes precedence.

1.3 Associated documents

Since this Technical Description contains only skill-specific information it must be used in association with the following:

- WSI – Code of Ethics and Conduct
- WSI – Competition Rules
- WSI – WorldSkills Occupational Standards framework
- WSI – WorldSkills Assessment Strategy
- WSI online resources as indicated in this document
- WorldSkills Health, Safety, and Environment Policy and Regulations.

2 The WorldSkills Occupational Standards (WSOS)

2.1 General notes on the WSOS

The WSOS specifies the knowledge, understanding, and specific skills that underpin international best practice in technical and vocational performance. It should reflect a shared global understanding of what the associated work role(s) or occupation(s) represent for industry and business (www.worldskills.org/WSOS).

The skill competition is intended to reflect international best practice as described by the WSOS, and to the extent that it is able to. The Standard is therefore 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 **WorldSkills Occupational Standards**

Section		Relative importance (%)
1	**Work organization and management**	**10**

The individual needs to know and understand:

- The various purposes and uses for BIM Modelling
- Standards currently used and recognized by industry (ISO 19650-1 and 19650-2)
- 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
- Recognized 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 (LOD's).
- 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.

The individual shall be able to:

- Apply the internationally recognized standards and standards currently used and recognized by industry
- Apply and promote health and safety legislation and best practice in the workplace
- Access and recognize standard component and symbol libraries
- Use and interpret technical terminology and symbols used in preparing and presenting Information Models, Structural and Architectural drawings
- 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 BIM
- Explain complex technical images to experts and non-experts, highlighting key elements

Section	Relative importance (%)

- 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 Visualizations of the desired project in order to fulfil the client's brief accurately

2	Software and hardware	5

The individual needs to know and understand:

- Computer operating systems to be able to use and manage computer files and software correctly
- Peripheral devices used in the BIM process
- Specific specialist technical operations within design software
- The workflow for BIM projects
- The limitations of the design software
- Formats and resolutions

The individual shall be able to:

- 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 CAD software such as a mouse, menu, or tool bar
- Configure the parameters of the software

3	Interpretation of the client brief	10

The individual needs to know and understand:

- 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 the project
- 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

Section	Relative importance (%)

The individual shall be able to:

- Interpret the client's brief to be able to determine:
    - Outline requirements of the project
    - Client goals
    - Location
- Work from a BEP and from the client Brief and EIR to address the client and project requirements
- Create and edit BIM information within the CDE as per the BEP across the lifecycle of the construction project and provide access/ set permissions to the necessary folders to the BIM team.

4	Modelling	25

The individual needs to know and understand:

- Programmes used in the BIM modelling and collaboration process
- Computer operating systems in order to use and manage computer files and software
- The importance of organizing BIM objects into meaningful groups of disciplinary information that can be managed visually
- How to create BIM Models (Structural/ Architectural)
- Principles of technical drawing
- 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
- 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

The individual shall be able to:

- Open an appropriate Project Information Model from the relevant directory within the CDE
- Populate the Project Properties with given information
- Set the model up as a collaborative file
- Create work set
- Set the project Location
- Create a structural grid.
- Create a BIM model as per given drawings
- Save the BIM model with a prescribed starting View
- Save the Project Information Model within the CDE for use by the other disciplines
- Adhere to the requirements of the BEP to ensure Data drops are made to the relevant folders as per the client's requirements.

Section	Relative importance (%)
5 **Coordination of models**	**15**

The individual needs to know and understand:

- 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

The individual shall be able to:

- Federate structural, Architectural and specialist designer projects
- Perform Hard Clash Inspections as per the BEP
- Export all tests as per the BEP and issue to the CDE
- Save and issue the federated file as per the BEP
- Quality assure the federated project model by "Walk around" the CDE hosted model.
- Identify issues with the coordination in the new build that haven't shown up in the three hard clash tests. For each issue discovered
    - Create the issue
    - Add annotation describing the issue
    - Assign the Issue to the BIM Manager on the project
- Name the view as per the BEP

6 **Corrective modelling**	**15**

The individual needs to know and understand:

- 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.

The individual shall be able to:

- 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

Section		Relative importance (%)
7	**Data extraction**	**15**

The individual needs to know and understand:

- 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.

The individual shall be able to:

- 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

Section		Relative importance (%)
8	**Visualization**	**5**

The individual needs to know and understand:

- The importance of being able to produce renderings of a model to a suitable quality for the client
- 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

The individual shall be able to:

- 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.

Total		**100**

3 The Assessment Strategy and Specification

3.1 General guidance

Assessment is governed by the WorldSkills Assessment Strategy. The Strategy establishes the principles and techniques to which WorldSkills assessment and marking must conform.

Expert assessment practice lies at the heart of the WorldSkills Competition. For this reason, it is the subject of continuing professional development and scrutiny. The growth of expertise in assessment will inform the future use and direction of the main assessment instruments used by the WorldSkills Competition: the Marking Scheme, Test Project, and Competition Information System (CIS).

Assessment at the WorldSkills Competition falls into two broad types: measurement and judgement. For both types of assessment, the use of explicit benchmarks against which to assess each Aspect is essential to guarantee quality.

The Marking Scheme must follow the weightings within the Standards. The Test Project is the assessment vehicle for the skill competition, and therefore also follows the Standards. The CIS enables the timely and accurate recording of marks; its capacity for scrutiny, support, and feedback is continuously expanding.

The Marking Scheme, in outline, will lead the process of Test Project design. After this, the Marking Scheme and Test Project will be designed, developed, and verified through an iterative process, to ensure that both together optimize their relationship with the Standards and the Assessment Strategy. They will be agreed by the Experts and submitted to WSI for approval together, in order to demonstrate their quality and conformity with the Standards.

Prior to submission for approval to WSI, the Marking Scheme and Test Project will liaise with the WSI Skill Advisors for quality assurance and to benefit from the capabilities of the CIS.

4 The Marking Scheme

4.1 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 WorldSkills 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. Please see the Rules for further details.

Experts and Independent Assessors are required to submit their Marking Schemes and Test Projects for review, verification, and validation well in advance of completion. They are also expected to work with their Skill Advisor, reviewers, and verifiers, throughout the design and development process, for quality assurance and in order to take full advantage of the CIS's features.

In all cases a draft Marking Scheme must be entered into the CIS at least eight weeks prior to the Competition. Skill Advisors actively facilitate this process.

4.2 Assessment 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. Each Assessment Criterion is defined by a letter (A-I). *The Assessment Criteria, the allocation of marks, and the assessment methods, should <u>not</u> be set out within 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 generated by the CIS will comprise a list of the Assessment Criteria and Sub Criteria.

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

4.3 Sub Criteria

Each Assessment Criterion is divided into one or more Sub Criteria. Each Sub Criterion becomes the heading for a WorldSkills 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.

4.4 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. This will be displayed in the Mark Allocation Table of the CIS, in the following format, when the Marking Scheme is reviewed from C-8 weeks. (Section 4.1 refers.)

					CRITERIA					TOTAL MARKS PER SECTION	WSSS MARKS PER SECTION	VARIANCE
		A	B	C	D	E	F	G	H			
STANDARDS SPECIFICATION SECTION	1	5.00								5.00	5.00	0.00
	2		2.00					7.50		9.50	10.00	0.50
	3								11.00	11.00	10.00	1.00
	4			5.00						5.00	5.00	0.00
	5				10.00	10.00	10.00			30.00	30.00	0.00
	6		8.00	5.00				2.50	9.00	24.50	25.00	0.50
	7			10.00				5.00		15.00	15.00	0.00
TOTAL MARKS		5.00	10.00	20.00	10.00	10.00	10.00	15.00	20.00	100.00	100.00	2.00

4.5 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. (Section 4.6 refers.)

4.6 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.

4.7 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. To avoid errors in calculation or transmission, the CIS provides a large number of automated calculation options, the use of which is mandated.

4.8 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.

4.9 Skill assessment strategy

WorldSkills is committed to continuous improvement. This particularly applies to assessment. The SMT is expected to learn from past and alternative practice and build on the validity and quality of assessment and marking.

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. For official compatriot communication, Rule 7.3.3 is strictly applied.

Module 1 – Understanding a BIM Execution Plan and Setting up of CDE
- Project workspace within a cloud based Common Data Environment
- File structure as per Current BIM standard
- Project Information Model
- Project properties
- Project location and orientation

Module 2 – Architectural Modelling
- Architectural worksets
- Coordination / linking of geospatial grids into architectural project information model
- Wall and floor styles
- Architectural Modelling
- Drawing views and presentation (Part judgement)

Module 3 – Structural Modelling

- Structural worksets
- Structural levels
- Coordination / linking of geospatial grids into structural project information model
- Structural grid
- Structural project information model
- Drawing views and Presentation (Part Judgement)

Module 4 - BIM Co-ordination

- Federate models
- Inspect models
- Report and assign issues

Module 5 – Corrective modelling

- Modify models
- Provide solutions to issues
- Structured asset data to current standards
- 4D Time scheduling information
- Drawing views and presentation (Part Judgement)

Module 6 – Data Extraction

- Shared Parameter File
- Custom parameters
- Custom Tags
- Schedules of Information
- Use of Filters on view
- Drawing views and presentation (Part Judgement)

Module 7 – Visualisation

- Photo rendering
- Animation
- VR

4.10 Skill assessment procedures

Assessment and marking are an intense process that depends upon skilful leadership, management, and scrutiny.

In accordance with WorldSkills Rules and guidance, on C-3 Mandatory Assessment Training will include 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 WSOS. 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.

In accordance with the Rules, there is no blind marking and no compatriot marking. 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 Chair and Vice Chair of the Competitions Committee. The Skill Advisor or Standards and Assessment Advisor must be contacted if this possibility is raised due to a lack of Experts with the required expertise.

5 The Test Project

5.1 General notes

Sections 0 and 4 govern the development of the Test Project. These notes are supplementary.

Whether it is a single entity, or a series of stand-alone or connected modules, the Test Project will enable the assessment of the applied knowledge, skills, and behaviours set out in each section of the WSOS.

The purpose of the Test Project is to provide full, balanced, and authentic opportunities for assessment and marking across the Standards, in conjunction with the Marking Scheme. The relationship between the Test Project, Marking Scheme, and Standards will be a key indicator of quality, as will be its relationship with actual work performance.

The Test Project will not cover areas outside the Standards, or affect the balance of marks within the Standards other than in the circumstances indicated by Section 2. This Technical Description will note any issues that affect the Test Project's capacity to support the full range of assessment relative to the Standards. Section 2.1 refers.

The Test Project will enable knowledge and understanding to be assessed solely through their applications within practical work. The Test Project will not assess knowledge of WorldSkills rules and regulations.

Most Test Projects (and Marking Schemes) are now designed and developed independently of the Experts. They are designed and developed either by the Skill Competition Manager, or an Independent Test Project Developer, normally from C-12 months. They are subject to independent review, verification, and validation. (Section 4.1 refers.)

The information provided below will be subject to what is known at the time of completing this Technical Description, and the requirement for confidentiality.

Please refer to the current version of the Competition Rules for further details.

5.2 Format/structure of the Test Project

The Test Project is a series of seven standalone modules that combine to complete a full project.

Skills that may be tested in the different modules could cover:

- Common Data Environments;
- Project Information models;
- Structural Modelling;
- Architectural modelling;
- Detail drawings;
- Creation of worksets;
- Model Co-ordination;
- Modification of a model to fulfil a client's brief;
- Data extraction
- Animation and photo rendering;
- Virtual reality.

A combination of the above skills is allowed in each module, but different competencies must be tested in each module.

5.3 Test Project design requirements

The competition is divided into six modules covering the following categories:

Day 1 (three hours) – Understanding a BIM Execution Plan and Setting up of CDE

Data:
- BIM Execution Plan
- Clients Brief
- Current Industry standards

Work requested:
- To Create a project workspace within a cloud based Common Data Environment;
- To set up file structure as per Current BIM standards;
- To set up a Project Information Model;
- To populate project properties;
- To set project location and orientation;
- To invite the project collaborators and set their required access rights

Results expected:
- A Cloud based Common Data Environment using Autodesk BIM360 for the project;
- The site location and orientation in the project environment is set to the requirements of the client brief;
- The document management file structure in the cloud based Common Data environment is set up as per current BIM standards;
- The collaboration team invited to the project with the required access rights;

Day 1 (three hours) – Architectural Modelling

Data:
- Geospatial grid details;
- BIM Execution Plan;
- Wall style drawing(s);
- Floor style drawing(s);
- Architectural Plans, elevations, sections and detail drawings;

Work requested:
- Creation of architectural worksets;
- Coordination / linking of geospatial grids into architectural project information model;
- To produce the Wall and floor styles;
- To produce an Architectural Modelling;
- Saving of the Architectural project information to the CDE;
- Drawing views and presentation as per required standards and the BIM execution plan (Part judgement);

Results expected:
- Architectural file set up as a collaborative file in the appropriate directory on the CDE;
- Worksets created as per the requirement of the BIM Execution Plan;
- Correct linking of the CAD Ordinance Survey tile to the Architectural model;
- External wall style created;
- Floor style created;
- Architectural levels created;
- Structural grid copied into Architectural project model;
- Plans, elevations, sections and details drawings;
- Save the Architectural project file within the CDE for use by other disciplines;

Day 2 (three hours) – Structural Modelling

Data:
- Structural grid drawing details;
- Finished steel structure drawing details;
- BIM Execution Plan;

Work requested:
- Creation of structural worksets;
- Creation of structural levels;
- Coordination / linking of geospatial grids into structural project information model;
- Creation of structural grid;
- Creation of structural project information model;
- Saving of the structural project information to the CDE;
- Drawing views and Presentation (Part Judgement);

Results expected:
- Structural grid drawing;
- Structural drawing(s);
- Save the structural project file within the CDE for use by other disciplines;

Day 2 (three hours) – BIM Co-ordination

Data:

- Finished Structural and Architectural Models;
- Other Discipline models;
- BIM Execution plan;

Work requested:
- To produce a Federated model;
- To perform a series of Inspections on the federated model;
- To Report and assign issues found on the CDE;

Results expected:

- A federated Structural, Architectural and other discipline project models;
- Hard clash detection of federated model;
- Quality assurance of the federated project model by 'Walking around' the CDE hosted model;
- Reporting and assigning of issues to CDE;

Day 3 (six hours) – Corrective modelling and data extraction

Data:
- Model change requirements from client;
- Structural and Architectural models;
- Nomenclature;
- All necessary additional information;

Work requested:
- To Modify models;
- To Provide solutions to issues;
- To Provide structured asset data to current standards;
- To Provide schedules of data
- Drawing views and presentation (Part Judgement);

Results expected:

- Client changes to structural and architectural models;
- A creative solution to the issue highlighted by the client;
- Structured asset Data drop of federated model;
- Schedules of Data with custom fields and associated views
- Dimensioned Floor plan drawings with tagged data on selected elements
- Elevations of the federated model with tagged data on selected elements

Day 4 (four hours) – Visualization

Data:

- Completed federated model;
- Client visualisation requirements;
- BIM execution plan;

Work requested:

- To produce Photo rendered images;
- To produce an internal and external Animation of the Federated model;
- To produce a VR experience for the client of the federated model;

Results expected:

- External and internal rendered images;
- External and internal animation;
- External and internal VR experience;

5.4 Test Project development

The Test Project MUST be submitted using the templates provided by WorldSkills International (www.worldskills.org/expertcentre). Use the Word template for text documents and DWG template for drawings.

5.4.1 Who develops the Test Project or modules

The Test Project/modules are developed by an Independent Test Project Designer in collaboration with the Skill Competition Manager.

5.4.2 When is the Test Project developed

The Test Project/modules are developed according to the following timeline:

Time	Activity
Six (6) months before the current Competition	The Test Project is to be developed.
One (1) month before the Competition	The Test Project must be submitted to WorldSkills Skills Competitions Administration Manager.
At the Competition	The Test Project modules are presented to Experts and Competitors.

5.5 Test Project initial review and verification

The purpose of a Test Project is to create a challenge for Competitors which authentically represents working life for an outstanding practitioner in an identified occupation. By doing this, the Test Project will apply the Marking Scheme and fully represent the WSOS. In this way it is unique in its context, purpose, activities, and expectations,

To support Test Project design and development, a rigorous quality assurance and design process is in place (Competition Rules sections 10.6-10.7 refer.) Once approved by WorldSkills, the Independent Test Project Designer is expected to identify one or more independent, expert, and trusted individuals initially to review the Designer's ideas and plans, and subsequently to verify the Test Project, prior to validation.

A Skill Advisor will ensure and coordinate this arrangement, to guarantee the timeliness and thoroughness of both initial review, and verification, based on the risk analysis that underpins Section 10.7 of the Competition Rules.

5.6 Test Project validation

The Skill Competition Manager coordinates the validation and will ensure that the Test Project/modules can be completed within the material, equipment, knowledge, and time constraints of Competitors.

5.7 Test Project selection

The Test Project/modules are selected by the Independent Test Project Designer in collaboration with the Skill Competition Manager.

5.8 Test Project circulation

If applicable, the Test Project is circulated via the website as follows:

The Test Project/modules are not circulated prior to the Competition. The Test Project/modules are presented to Competitors at the Competition at the beginning of each module.

5.9 Test Project coordination (preparation for Competition)

Coordination of the Test Project/modules is undertaken by the Skill Competition Manager.

5.10 Test Project change

There is no 30% change required to be made to the Test Project/modules at the Competition. Exceptions are amendments to technical errors in the Test Project documents and to infrastructure limitations.

5.11 Material or manufacturer specifications

Specific material and/or manufacturer specifications required to allow the Competitor to complete the Test Project will be supplied by the Competition Organizer and are available from www.worldskills.org/infrastructure located in the Expert Centre. However, note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These such items may include those for fault finding modules or modules not circulated.

BUILDING INFORMATION MODELLING

6 Skill management and communication

6.1 Discussion Forum

Prior to the Competition, all discussion, communication, collaboration, and decision making regarding the skill competition must take place on the skill specific Discussion Forum (http://forums.worldskills.org). Skill related decisions and communication are only valid if they take place on the forum. The Chief Expert (or an Expert nominated by the Chief Expert) will be the moderator for this Forum. Refer to Competition Rules for the timeline of communication and competition development requirements.

6.2 Competitor information

All information for registered Competitors is available from the Competitor Centre (www.worldskills.org/competitorcentre).

This information includes:

- Competition Rules
- Technical Descriptions
- Mark Summary Form (where applicable)
- Test Projects (where applicable)
- Infrastructure List
- WorldSkills Health, Safety, and Environment Policy and Regulations
- Other Competition-related information

6.3 Test Projects [and Marking Schemes]

Circulated Test Projects will be available from www.worldskills.org/testprojects and the Competitor Centre (www.worldskills.org/competitorcentre).

6.4 Day-to-day management

The day-to-day management of the skill during the Competition is defined in the Skill Management Plan that is created by the Skill Management Team led by the Skill Competition Manager. The Skill Management Team comprises the Skill Competition Manager, Chief Expert, and Deputy Chief Expert. The Skill Management Plan is progressively developed in the six months prior to the Competition and finalized at the Competition by agreement of the Experts. The Skill Management Plan can be viewed in the Expert Centre (www.worldskills.org/expertcentre).

6.5 **General best practice procedures**

General best practice procedures clearly delineate the difference between what is a best practice procedure and skill-specific rules (section 9). General best practice procedures are those where Experts and Competitors CANNOT be held accountable as a breach to the Competition Rules or skill-specific rules which would have a penalty applied as part of the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System. In some cases, general best practice procedures for Competitors may be reflected in the Marking Scheme.

Topic/task	Best practice procedure
Equipment failure	• In the occurrence of equipment failure Competitors must notify Experts immediately by raising their hand. Experts will take note of the time that the Competitor is not able to make use of their equipment. Any time lost due to equipment failure is provided to the Competitor at the end of the standard module time. No additional time is granted for work not saved prior to the equipment failure.
Communication and contact between compatriot Expert and Competitor	• No communication during breaks or lunch time between Expert/Interpreter and Competitor. • Competitor and compatriot Expert/Interpreter cannot be outside the competition area at same time unless is approved by Chief Expert.

BUILDING INFORMATION MODELLING

7 Skill-specific safety requirements

Refer to WorldSkills Health, Safety, and Environment Policy and Regulations for Host country or region regulations.

Task	Sturdy shoes with closed toe and heel
General PPE for safe areas	√
Competitor workstations	√

8 Materials and equipment

8.1 Infrastructure List

The Infrastructure List details all equipment, materials, and facilities provided by the Competition Organizer.

The Infrastructure List is available at www.worldskills.org/infrastructure.

The Infrastructure List specifies the items and quantities requested by the Skill Management Team for the next Competition. The Competition Organizer will progressively update the Infrastructure List specifying the actual quantity, type, brand, and model of the items. Note that in some cases details of specific materials and/or manufacturer specifications may remain secret and will not be released prior to the Competition. These such items may include those for fault finding modules or modules not circulated.

At each Competition, the Skill Management Team must review and update the Infrastructure List in preparation for the next Competition. The Skill Competition Manager must advise the Director of Skills Competitions of any increases in space and/or equipment.

At each Competition, the Technical Observer must audit the Infrastructure List that was used at that Competition.

The Infrastructure List does not include items that Competitors and/or Experts are required to bring and items that Competitors are not allowed to bring – they are specified below.

8.2 Competitors toolbox

Competitors are not allowed to send a toolbox to the Competition. All tools are provided by the Competition Organizer.

8.3 Materials, equipment, and tools supplied by Competitors

Competitors may bring the following to the Competition.

- Compendium of standards;
- Technical manuals;
- Instruments for freehand sketching;
- Measuring instruments;
- Personal keyboard and mouse (including drivers), if different than the ones supplied by Host Member;
- "Space Mouse" (3D Mouse) is allowed. Different electronic equipment must be presented to the Expert team for validation

Competitors are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.

8.4 Materials, equipment, and tools supplied by Experts

Experts are not required to bring materials, equipment, or tools. All is supplied by the Competition Organizer.

Experts are required to supply their own Personal Protective Equipment as specified in section 7 skill-specific safety requirements.
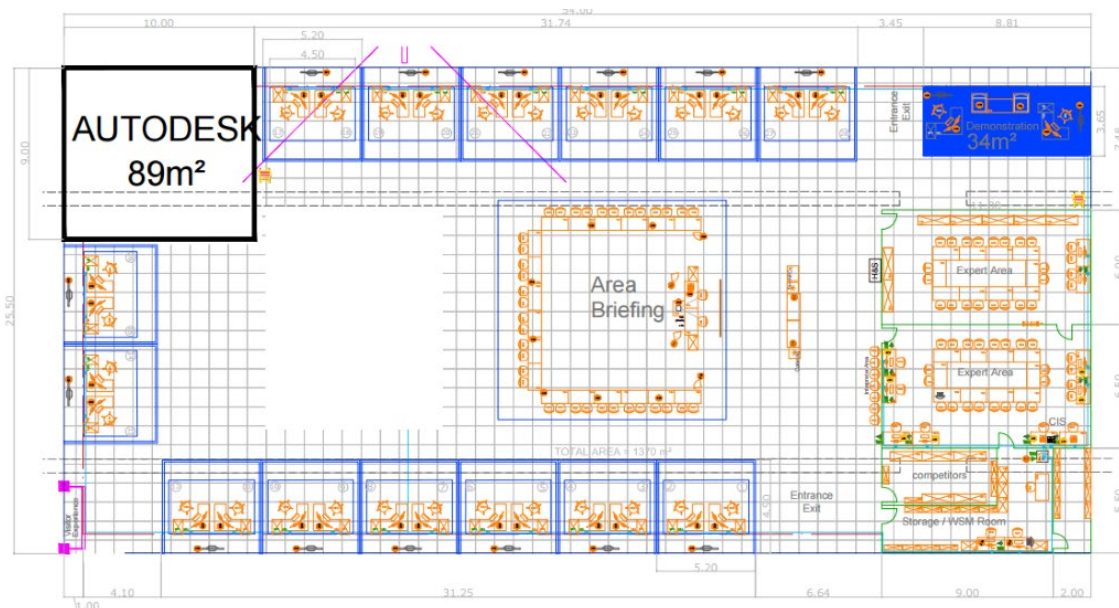
8.5 Materials and equipment prohibited in the skill area

Competitors and Experts are prohibited to bring any materials or equipment not listed in section 8.3 and section 8.4 .

8.6 Proposed workshop and workstation layouts

Workshop layouts from previous competitions are available at www.worldskills.org/sitelayout.

Example workshop layout

9 Skill-specific rules

Skill-specific rules cannot contradict or take priority over the Competition Rules. They do provide specific details and clarity in areas that may vary from skill competition to skill competition. This includes but is not limited to personal IT equipment, data storage devices, Internet access, procedures and workflow, and documentation management and distribution. Breaches of these rules will be solved according to the Issue and Dispute Resolution procedure including the Code of Ethics and Conduct Penalty System.

Topic/task	Best practice procedure
Use of technology – USB, memory sticks	• No external memory devices are to be connected to the competition computer unless under the supervision of the Chief Expert and Deputy Chief Expert. • Competitors are not allowed to load any digital data to their competition computers.
Use of technology – personal laptops, tablets, and mobile phones	• Skill Competition Manager, Chief Expert, Deputy Chief Expert, Experts, and Interpreters are allowed to use personal laptops, tablets and mobile phones in the Expert room only. • Competitors are not allowed to bring personal laptops, tablets, or mobile phones into the workshop. If these items are brought, they are to be locked in the personal locker and can be removed at the end of the day only. • Wireless Headphones are not allowed.
Use of technology – personal photo and video taking devices	• During module three the use of personal photo and video taking devices is forbidden in the workshop.
Drawings, recording information	• Competitors are not permitted to bring notes into the workshop under any circumstances. All notes made at the Competitor workstation must remain on the Competitors desk at all times. No notes may be taken outside of the workshop until the competition has concluded on C4.

10 Visitor and media engagement

Following is a list of possible ways to maximize visitor and media engagement:

- Try-a-Skill;
- Display screens;
- Test Project descriptions;
- Enhanced understanding of Competitor activity;
- Competitor profiles;
- Career opportunities;
- Daily reporting of competition status;
- Virtual Reality experience;
- Sponsors booth.

BUILDING INFORMATION MODELLING

11 Sustainability

This skill competition will focus on the sustainable practices below:

- Recycling;
- Use of "green" materials;
- Use of completed Test Projects after Competition;
- Use of digital information instead of paper.

12 **References for industry consultation**

WorldSkills is committed to ensuring that the WorldSkills Occupational Standards fully reflect the dynamism of internationally recognized best practice in industry and business. To do this WorldSkills approaches a number of organizations across the world that can offer feedback on the draft Description of the Associated Role and WorldSkills Occupational Standards on a two-yearly cycle.

In parallel to this, WSI consults three international occupational classifications and databases:

- ISCO-08: (http://www.ilo.org/public/english/bureau/stat/isco/isco08/)
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.**oneto**nline.org/)

The following table indicates which organizations were approached and provided valuable feedback for the Description of the Associated Role and WorldSkills Occupational Standards in place for WorldSkills Shanghai 2021.

Organization	Contact name
Autodesk	John Herridge, AEC Technical Marketing Manager Autodesk Education Experiences
Autodesk	Philipp Mueller, Program Manager AEC, EMEA, Autodesk Educational Experiences
Autodesk	Part Manin, Ph.D., Technical Director Autodesk CIS
Baker Hicks	Gary Hogg, Senior BIM & Technology Manager
Baker Hicks	Alisder Brown, Senior BIM co-ordinator
New College Lanarkshire	Michael McGuire, Chair of the Qualifications Support Team PDA BIM, Computer Aided Architectural Design and Technology at SQA
Technological University Dublin	Malachy Mathews, Senior Lecturer, School of Architecture; Board member- International Congress Architectural Technology ICAT; Co-founder – Integrated Engineering Blockchain Consortium IEBC
Salford University	Professor Jason Underwood, Program director MSc. BIM & Digital Built Environments; Director of Construct IT for Business; Chair BIM Academic Forum.