Building Information Modelling
建築資訊模型

worldskills

Technical Description 技術說明書

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:

依據競賽委員會之決議及遵照組織章程、常規與競賽規則所定，WorldSkills組織通過採行 WorldSkills競賽中此職類之最低規範要求如下文。

此技術說明書包含如下內容：

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1 Introduction 介紹

1.1 Name and description of the skill competition 職類名稱與說明

1.1.1 The name of the skill competition is 此職類的名稱為

Building Information Modelling (BIM) 建築資訊模型（BIM）

1.1.2 Description of the associated work role(s) or occupation(s) 相關工作角色或職業說明

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.

建築資訊模型（BIM）是在專案生命週期全程，建立和管理建築專案之資訊的程序。此程序的主要產出之一即為建築資訊的模型，也就是建築資產各方面的數位描述。此模型所利用的是在專案主要階段協同收集與更新的資訊。建立數位建築資訊模型可使與此建築互動合作的人員，能夠有最佳的行動決策，進而為此資產帶來更大的壽命價值。

隨著新BIM時代的到來，設計與建築產業正處理著「 BIM」旗下所出現軟體技術的爆炸式增長，讓建築的設計、工程與建造，產生了從設計故事到工程計算、再到最後的建築完工的指數變化，此意味著，憑藉現有的專業，在履行建築資訊模型建立者的角色時，會面臨不同的需求、新的工作流程，以及新的技能。

這個角色能否成功，關鍵即在於合作。比起以往，BIM更需要高階的人力技能，能夠溝通、合作並具主動性。BIM需要引進擁有更優秀技能的專業人員，讓建築師、工程師與承包商能夠合作共事，結合並增強其集體產出，要求在技術技能、BIM、溝通技能上能有更為複雜高階的合作，而這些皆必須符合專業標準。

電腦輔助設計是運用電腦系統輔助BIM模型的建立、修改、分析與最適化的工具。 CAD軟體係用於提高BIM模型建立者的生產率，改善設計質量，改善文件往返的溝通，以及建立用於實施專案的資料庫。CAD通常是以電子檔案的形式輸出，用於雲端分享、雲端協作、調查、製造，或是其他構建過程。技術與建築的模型與圖像，必須根據特定應用協定來傳達資訊，例如專案位置、建築的組織要素，以及結構化資料。CAD亦可用於在BIM生命週期全程做出電腦動畫、VR及AR體驗，包括廣告與技術手冊。

CAD是執行BIM的重要產業工具，也是建築專案實現的方式，其過程與輸出對於找出構造、工程、製造問題的成功解決方案至為重要，透過合併多個模型，進行軟硬碰撞檢測分析，使能建立聯合模型。CAD軟體可幫助我們透過擬真著色和影片來探索想法，讓概念視覺化，並模擬BIM專案在現實世界中的表現。

新技術透過增強、增添及修改可創造出新的職業。建築資訊模型建立者的角色是一個新興的職業，令人極為期待其未來的職業路徑發展。

1.1.3 **Number of Competitors per team** 每個團隊的選手數

Building Information Modelling is a single Competitor skill competition.

建築資訊模型為個人選手的競賽職類。

1.1.4 Age limit of Competitors 選手的年齡限制

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

選手在參賽當年不得超過25歲。

1.2 The relevance and significance of this document 本文件的相關性與重要性

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.

這一份技術說明書包含了此職類競賽所要求的標準、評分原則,以及控管此競賽之方法與程序的相關訊息。

每一位裁判與選手皆須知道並瞭解技術說明書所述內容。

技術說明書在各個不同語言版本之間如有任何衝突,以英文版本為準。

1.3 Associated documents 相關文件

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.

技術說明書僅包含與技術有關的訊息,因此須與下列文件搭配運用:
- WSI—「道德行為準則」
- WSI—「競賽規則」
- WSI—「WorldSkills 職業標準」架構
- WSI—「WorldSkills 評量策略」
- 此文件中所指出的WSI線上資源
- 「WorldSkills衛生安全與環境政策法規」

2 The WorldSkills Occupational Standards (WSOS)
國際技能職業標準

2.1 General notes on the WSOS 一般須知

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.

WSOS說明的是國際上技術與職業表現之最佳實務的知識、認知及特定技能，其應能反映出全球對於代表產業與商業的相關工作角色或職業的共通認知(www.worldskills.org/WSOS)。

此技能競賽欲反映出WSOS中所描述的全球最佳實務及其所能達到的程度， 因此，此標準即為技能競賽所需之訓練與準備的指南。

對於選手在知識及瞭解程度上的評量，會透過競賽中對於選手表現的評量反映出來，除非有足夠的理由，才需針對知識與瞭解程度另做測驗。

此標準有分成了數個不同項目來說明，每一個項目皆有加上標題與編號。

每一個項目會分配一個百分比，以標示其在此標準中的相關重要性，通常稱之為「權重」。百分比的總和為100。

透過試題，評分方案將僅就此標準中所指出的技能範疇來評估，會在技能競賽的限制範圍內，盡可能地完整反應出此標準。

評分方案與試題會盡可能地合乎此標準的配分原則，只要在實際運作時並不會扭曲此標準所定之比重，則可容許百分之五的變動程度。

2.2 WorldSkills Occupational Standards 國際技能職業標準

Section 項目	Relative importance (%) 相對重要性 (%)
1 Work organization and management 工作組織與管理	**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.

個人須知道並瞭解：

- BIM模型的各種目的與用途。
- 產業界現今所使用與認可的標準（ISO 19650-1 及19650-2）。
- 與使用影像顯示器（VDU）及在工作站環境中的相關衛生與安全規章及最佳實務。
- 術語與符號。
- 辨認IT系統及相關專業設計軟體。
- 資訊目的與細節程度之間的關聯，需要準確、明確地溝通設計用意，請參考「細節程度」（LOD's）。
- 與同事、業主及其他相關專業領域人員之間，具備有效人際溝通能力的重要性。
- 知識與技能皆能與時俱進的重要性。
- 對於技術及設計的問題與挑戰，提出創新與具創意的解決分案。.
- 能夠按照BEP（BIM執行計畫）交付任務與在期限內執行的重要性。
- 按照業主要求執行的重要性。

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

- 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

個人須能夠：

- 應用國際認可的標準，以及業界現行與認可的標準。
- 應用與推行衛生與安全規章及工作場所的最佳實務。
- 存取與辨認標準元件與符號資料庫。
- 使用與詮釋用於準備與呈現資訊模型、結構及建築圖面的術語與符號。
- 使用經認可的IT系統及相關專業設計軟體，以持續產出高品質的設計與詮釋。
- 處理協調問題，例如因已修改之共享要素而收到的警示。
- 在設計與呈現設計及模型資訊給潛在使用者時，執行持續符合具準確性、明確性之高標準的工作。
- 使用與同事、業主及其他相關專業領域人員之間的有效人際溝通能力，確保BIM模型過程符合BEP需求。
- 向業主與其他專業領域人員描述BIM的角色與目的。
- 向專家與非專家說明複雜技術圖像，強調關鍵要素。
- 保持主動且持續的專業發展，以保有新的、發展中技術與實踐的知識與技能。
- 對於技術與設計的問題及挑戰，提供並應用創新與具創意的解決分案。
- 提供所欲達成專案的一系列視覺化展示，以能精確完成業主要求所列任務。

Section 項目	Relative importance (%) 相對重要性 (%)

2   Software and hardware 軟體與硬體   **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

個人須知道並瞭解：

- 電腦操作系統，以能夠正確使用和管理電腦檔案與軟體。
- BIM過程中所使用的週邊設備。
- 設計軟體中的特定專業技術操作。
- BIM專案的工作流程。
- 設計軟體的侷限。
- 格式和解析度。

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

個人須能夠：

- 啟動設備電源，開啟合適的模型軟體。
- 設置並檢查周邊設備，例如鍵盤和滑鼠。
- 使用電腦操作系統和專業軟體，熟練地在本機與共用資料環境建立、管理、儲存檔案。
- 從螢幕選單或圖示，選擇正確的繪圖工具。
- 使用各種技巧以存取、使用CAD軟體，例如滑鼠、選單或工具列。
- 設定軟體參數。

3   Interpretation of the client brief 解讀業主要求   **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

個人須知道並瞭解：

- 業主要求中有包含哪些資訊。
- 「交換資訊要求」（EIR）的重要性。
- 專案「資產資訊需求」（AIR）的重要性。
- 相關的、現今的業界標準。
- 如何從EIR的「BIM執行計劃」（BEP）來執行工作。
- 如何在建築的生命週期全程，於「共用資料環境」（CDE）中建立和編輯BIM資訊。.
- 在CDE中檔案結構和共享協定的重要性。

Section 項目	Relative importance (%) 相對重要性 (%)

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.

個人須能夠：

- 解讀業主要求，以決定出：
  - 專案的概要需求
  - 業主的目標
  - 位置
- 從BEP、業主要求及EIR來執行工作，以處理業主與專案的需求。
- 根據建築專案生命週期全程的BEP，在CDE中建立與編輯BIM資訊，向BIM團隊提供必要資料夾的存取／設置權限。

4	Modelling 建模	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

個人須知道並瞭解：

- BIM建模和協作過程中所使用的程序
- 電腦操作系統，以能使用與管理檔案與軟體。
- 將BIM構件組織成能夠視覺化管理的有意義之專業領域資訊群的重要性。
- 如何建立BIM模型（結構／建築）
- 技術圖紙的原則。
- 如何在BIM專案中存取和使用文件。
- 如何將BIM模型設置為協作檔案。
- 如何設置專案位置。
- 使用「進展中」（WIP）資料夾
- 主要專案階段之資訊交換（「Data drops／資料交換」）及按照

Section 項目	Relative importance (%) 相對重要性 (%)

BEP需求工作的重要性。

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.

個人須能夠：

- 從CDE中的相關目錄中，開啟合適的「專案資訊模型」。
- 以已知資訊定出專案屬性。
- 將模型設置為協作文件。
- 建立工作集
- 設置專案位置。
- 建立結構網格。
- 根據所給圖紙建立BIM模型。
- 以指定的起始視圖儲存BIM模型。
- 將專案資訊模型儲存於CDE中，供其他專業領域的人員使用。
- 遵守BEP需求，確保將「資料交換」根據客戶要求置於相關資料夾。

5	**Coordination of models 模型協調**	**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

個人須知道並瞭解：

- 如何以相同的模型格式來聯合不同專業領域的模型。
- 什麼是硬碰撞，以及如何使用BEP來確保設備／責任是可達成、可執行硬碰撞檢查。
- 如何將硬問題上傳並報告至BIM專案和CDE。
- 如何執行和記錄軟碰撞檢查的詳細資訊。

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

個人須能夠：

- 聯合結構、建築和專業設計師專案。
- 根據BEP進行硬碰撞檢查 。
- 根據BEP匯出所有測試，並發出給CDE。
- 根據BEP儲存並發出聯合檔案。
- 藉由在CDE主模型中「四處走動」，確保聯合專案模型的品質。
- 辨認在新建造中，尚未在三個硬碰撞測試出現過的協調問題，對於每個發現的問題：
  - 確立問題
  - 增加註解，以描述問題。
  - 將問題分派給專案的 BIM經理。
- 根據BEP為視圖命名。

6	**Corrective modelling 校正建模**	**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.

個人須知道並瞭解：

- 建築資訊模型的現今文件標準。
- 如何以結構資產資料定出模型。
- 模型要素的分類資訊。
- 如何製作按比例繪製的詳細圖紙，以達到所要求的標準。
- 如何根據現今標準，做出給定的細節。

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

個人須能夠：

- 從公布的目錄來更新「專案資訊模型」。
- 確保所有必要資產均已按照最新標準定出必要資料。
- 將分類資訊增加到模型要素–請參閱BEP專案。
- 從現已校正的聯合專案模型中，製作尺寸平面圖和立面圖。

Section	Relative importance (%)
7 **Data extraction** 提取資料	**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.

個人須知道並瞭解：

- 從數位模型建立與提取資料，以供專案的利害關係人使用的重要性
- 如何建立「共享參數」檔案，以供自訂資料所需
- 如何使用自訂資料欄位來建立專案資訊計畫表
- 如何使用帶有參數的篩選器，以能視覺化表達自訂資料的要求
- 如何建立視覺化形式，以表達有關火與熱傳導率u值或類似值的法規規範。

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

個人須能夠：

- 使用自訂參數來建立對於選取之建築要素的「共享參數」
- 建立自訂標籤，以能視覺化表達來自於自訂參數的技術資訊
- 建立色彩濾鏡，以能視覺化表達來自於重複計劃、剖面及3D切割剖面上自訂參數的技術資訊
- 建立包括自訂參數的專案資訊計畫表

Section	Relative importance (%)
8 **Visualization** 視覺化	**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

個人須知道並瞭解：

- 能夠做出適合業主要求品質之著色模型的重要性。

- 如何在模型上做出完全著色的動畫。
- 使用視覺化的構圖、背景和其他元件，為業主提供更真實呈現的模型。
- 如何在模型中建立可展示太陽移動及一天中時間變化的視覺化效果。

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.

個人須能夠：

- 使用合適的軟體，建立可高度精確呈現的聯合專案資訊模型，供行銷之用，包括動畫與VR模型。
- 使用構圖、燈光及背景，以達到最佳效果。
- 考慮並確定周圍環境及圖庫中其他元件的位置。

Total 總計   **100**

3 The Assessment Strategy and Specification
評量策略與規範

3.1 General guidance 總則

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.

評量是由「WorldSkills評量策略」來管控，此策略定出WorldSkills評量必須遵行的原則與技巧。

裁判評量作業是WorldSkills競賽的核心，因此，這部分是持續專業發展與審查的重點。發展評量專業可傳達出WorldSkills競賽主要評量工具未來的使用與方向：評分方案、試題，以及「競賽資訊系統」（CIS）。

WorldSkills競賽的評量可分為兩大類型：測量與判斷，這兩種評量類型的每一個評分項目皆須有明確的基準，此即為品質保證的重要關鍵。

評分方案必須遵照在標準規範中所定出的權重，試題是技能競賽的評量工具，亦須遵照標準規範的規定。CIS可確保分數記錄的即時性與正確性，其系統亦持續擴充其審查、支援與回饋的能力。

評分方案的要點會引導試題設計的過程，之後會再透過反覆程序，設計發展出評分方案與試題，以確保兩者皆最能切合標準規範與評分策略的要求。擬訂的評分方案與試題須經裁判們同意，並提呈WSI，供其核准，以證實其品質，確保符合標準規範。

在提呈WSI核准之前，評分方案與試題須送請WSI技能顧問審視，以確保品質，並確定可自CIS功能中得到助益。

4 The Marking Scheme 評分方案

4.1 General guidance 總則

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.

這部分將說明評分方案的角色與地位、裁判如何評量選手透過試題所呈現的成果,以及評分的程序與必要條件。

評分方案是WorldSkills競賽的重要工具,負責將評量與代表該技能的標準連在一起,其設計是在符合標準規範所定的權重原則之下,就每一個表現的評分項目來配分。

評分方案定出了試題設計的參數,以反映出標準規範所定的權重。根據職類的本質與其評估所需,一開始即將評分方案規劃得詳細些會較為合適,如此則可讓試題的設計以之為指南,或者在試題初擬時,即根據評分方案的綱要來設計。從這樣的觀點來推論,我們可說評分方案與試題應同步設計。

在上述第2.1節中,列出了評分方案與試題可與標準規範所定權重偏離的程度,若無其他合適的配套選項,則依條文所述為規範。

為了達到誠信與公平,愈來愈多的評分方案與試題是由具備相關專業的一人或數人來設計與制定,在這樣的情況下,裁判們要等到職類競賽或競賽模組開始的前一刻,才會看到評分方案與試題。若是由裁判們設計詳細的最終版評分計畫與試題,則在提呈做為獨立驗證與品質確保依據之前,須經所有裁判們核准同意。關於進一步的細節規範,請見競賽規則所述。

裁判與獨立評審員在完成評分方案與試題之前,須先行提出以供審查、確認與驗證,亦須在設計與制定的整個過程中,與技能顧問、審查員及驗證者合作,以確保品質,並藉助CIS的功效來設

計。

無論如何，擬定的評分計畫至少須在競賽開始的8個星期前，鍵入CIS系統，技能顧問會積極協助此程序的進行。

4.2 Assessment Criteria 評量標準

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 not 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.

評分方案的主要標題即為「評量標準」，這些標題是在設計試題之前或是與試題設計同時所訂出。有些職類的評量標準可能會與標準規範內容的項目標題相似，而有些職類則是完全不同。一般來說，評量標準的數量會介於五到九項之間。不論標題相符否，評分方案必須反映標準規範中所定的權重。

評量標準是由設計評分方案的一人或數人所訂出，將最適合試題的評量與評分的標準定義出來，每一項評量標準都會給定對應的字母（A-I）。*技術說明書中不應訂出評量標準、配分，及評量方法，因為標準、配分及評量方法皆是視評分方案與試題的本質來決定，且是在技術說明書公布之後才會確定。*

由CIS系統所製作的評分總表，會包含評量標準與次評量標準的列表。

分配至每一項標準的分數都會由CIS系統計算出來，在該項評量標準裡，每一個評分細項的分數都會累計加總。

4.3 Sub Criteria 次評量標準

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.

每項評量標準皆會分出一個或數個次評量標準，每一項次評量標準即是WorldSkills評分表格的標題。每一份評分表格（次評量標準），都會包含著分屬於測量評分或判斷評分的評分細項，或是同時包含測量與判斷評分的評分細項。

每一份評分表格（次評量標準）皆會寫明其評分日期，以及負責的評分小組。

4.4 Aspects 評分細項

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

SAMPLE OF TABLE FROM CIS

每個評分細項皆會詳細定義出要評分的單一項目、分數，以及給分的詳細說明與指示，每個評分細項皆是分屬於測量評分或判斷評分。

評分表格詳細列出了每個待評分的評分細項，及其配分。所有評分細項配分的加總總和須落在標準規範中該技能項目所定出的分數範圍之內。當自C-8星期審視評分方案之後，此資訊即會顯現在CIS的分數分配表上，如下列格式所示。（第4.1節）

標準										各項目總分	各項目WSOS總分	誤差
		A	B	C	D	E	F	G	H			
標準規範項目	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
總分		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 評量與評分

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.)

每一個次評量標準將由一組評分小組來評分,不論其為判斷評分、測量評分或兩者皆有,所有選手的同一個次評量標準項目,皆是由同一組評分小組來評。當此方式不可行時(例如所有選手皆須同時做出同一個動作步驟,且裁判須觀察該動作),則在經競賽委員會管理小組核准之後,會執行第二層的評量與評分。評分小組須經妥善分配,以確保不會有同國評分的狀況發生。(請參閱第4.6節)

4.6 Assessment and marking using judgement 判斷評分

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.

判斷評分使用0-3分的量表，為能精確且一致地應用此量表，判斷評分須依下列規則來執行：

- 每一個評分細項要有詳細指引的評估基準（標準）（以文字、圖、製造物或另外的指示說明）
- 0-3分量表所代表的意義為：
    - 0：表現低於業界標準
    - 1：表現達到業界標準
    - 2：表現達到業界標準，且在某些面向高於標準
    - 3：所有的表現皆高於業界標準，表現傑出

三位裁判將就每一個評分細項來評分，通常為同時評分，各自記錄分數。第四位裁判會調節、監督評分，並檢查有效性，而當要避免同國裁判評分時，其可加入評分。

4.7 Assessment and marking using measurement 測量評分

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.

每一個評分細項通常會由三位裁判來評分，第四位裁判負責監督。在有些情況下，評分小組可安排分為兩人一組，共兩組，來做雙重評分。除非另有說明，否則只能給予最高分數或0。若可給中間分數，則會在該評分細項的說明中清楚定義出依循的基準。為了避免計算或傳輸錯誤，CIS提供了大量的自動計算選項，且是強制要求使用。

4.8 The use of measurement and judgement 測量與判斷評分的應用

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.

關於評量標準的選擇與評量的方式，將會於競賽的設計期間，在評分方案與試題中訂出。

4.9 Skill assessment strategy 技能評量策略

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

WorldSkills致力於持續改進發展，尤其是在評量這方面。期許SMT能從以往的、所選用的實務操作中學習，建立起評量與評分的效度與品質。

此職類是屬於每天皆有「挑錯」試題的職類，因此，在競賽期間，包括休息和午餐時間，裁判皆不得與選手進行溝通。 關於與同國選手的正式溝通方式，將會嚴格執行競賽規則第7.3.3條文的規定。

模組一－了解「BIM執行計劃」並設置CDE

- 在雲端共用資料環境裡的專案工作區
- 符合「現今BIM」標準的檔案結構
- 「專案資訊模型」
- 專案屬性
- 專案位置和導向

模組二－建築建模

- 建築工作集
- 將地理空間網格納入建築專案資訊模型中的協調／連結工作
- 牆壁和地板樣式
- 建築建模
- 繪製視圖和展示（屬判斷部分）

模組三－結構建模

- 結構工作集
- 結構層次
- 將地理空間網格納入結構專案資訊模型中的協調／連結工作
- 結構網格
- 結構專案資訊模型
- 繪製視圖和展示（屬判斷部分）

模組四－BIM協調

- 聯合模型
- 檢查模型
- 報告並分派問題

模組五－校正建模

- 修改模型
- 為問題提供解決方案
- 使結構化資產資料符合現今標準
- 4D時間排程資訊
- 繪製視圖和展示（屬判斷部分）

模組六－資料提取

- 「共享參數檔案」
- 自訂參數
- 自訂標籤
- 資訊計畫表
- 視圖使用篩選器
- 繪製視圖和展示（屬判斷部分）

模組七－視覺化

- 照片著色
- 動畫
- VR虛擬實境

4.10 **Skill assessment procedures** 技能評量程序

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.

評量與評分的過程激烈，需要熟練的領導與管理，以及審查機制。

根據WorldSkills競賽規則和指南，C-3日的強制評量訓練，將包括對每位裁判在技術、評量與評分方面的專業能力，來做實際評估。接著，裁判長將確定誰會進行評分，以及誰將有機會透過觀察來增強其專業能力。

評分小組將依據次評量標準，而次評量標準又將反映WSOS中的權重。關於哪一組評分小組將評哪些次評量標準，會在競賽評量計劃及每個模組的辦理和時間安排中確定。

一個評分小組必須針對一項次評量標準中的所有評分細項來評分。

根據競賽規則所規定，不會有盲樣評分和同國裁判評分。每個評分小組的組成皆須確保遵守這些限制。

只有在競賽委員會主席和副主席同意時，才允許對競賽規則的規定有例外處理。如果由於缺少具有所需專業的裁判而導致有此可能，則必須聯繫技能顧問或標準與評量顧問。

5 The Test Project 試題

5.1 General notes 總則

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.

第0及第4節條文規範了試題的制定設計。這部分的註解係供補充說明之用。

不論是單一作品,或是一系列獨立或有關聯的模組,試題的設計將有助於對WSOS每個項目所列的知識、技能與行為進行評估。

試題的目的是在標準規範各個項目之間,提供完整、平衡且真實的機會,結合評分方案的要求,對成品給予評量與評分。試題、評分方案與標準規範之間的關係,將是品質的關鍵指標,也因此亦是實際工作表現的關鍵指標。

試題的範圍並不會延伸至標準規範以外的項目,而除了第2節條文所述的情況之外,試題的設計並不會影響標準規範中分數的平衡。此技術說明書將記錄影響試題支援標準規範中全面評估能力的任何事件與問題。請參閱第2.1節所述。

試題要能夠單就實際成品的表現,即可從中進行知識與認知的評量。試題不會針對WorldSkills規則與規範的知識來評量。

現今大多數的試題(及評分方案)都無需裁判們來出題,而是由職類經理,或者是獨立的出題專家來負責設計和制定,通常是從C-12個月開始此程序,所出的試題必須再經過獨立審查、驗證和確認。(請參閱第4.1節)

以下所提供的資訊,將以此技術說明書完成時所知之情況以及保密要求為準。

關於更多的細節說明,請參閱目前所公布的《競賽規則》版本。

5.2 Format/structure of the Test Project 試題的格式／結構

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.

此試題是由七個獨立模組所組成的一系列模組，所有模組經結合而完成一個完整的項目。可在不同模組中測試的技能可能包括有：

☐ 共用資料環境；
☐ 專案資訊模型；
☐ 結構建模；
☐ 建築建模；
☐ 詳細圖紙；
☐ 建立工作集；
☐ 模型協調；
☐ 修改模型以滿足業主需求；
☐ 資料提取
☐ 動畫及照片著色；
☐ 虛擬實境。

每個模組皆可設計結合使用多種上述技能，但是每個模組皆須針對不同的能力來測試。

5.3 Test Project design requirements 試題設計要求

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;

競賽分有六個模組，涵蓋以下的類別：

第一天（三個小時）－了解「BIM執行計劃」和設置CDE
資料：
- 「BIM執行計劃」；
- 業主要求 ；
- 「現今產業」標準 ；

必要工作：
- 在雲端「共用資料環境」中建立專案工作區；
- 按照「現今BIM」標準設置檔案結構；
- 建立「專案資訊模型」；
- 定出專案屬性；
- 設置專案位置和導向；
- 邀請專案協作者，設定其所需的存取權限。

預期結果：
- 針對專案使用Autodesk BIM360，建立雲端「共用資料環境」；
- 根據業主需求設置專案環境中的專案位置和導向；
- 按照現今BIM標準，設置雲端「共用資料環境」中的文件管理檔案結構；
- 獲邀的專案協作團隊有所需的存取權限。

第一天（三個小時）－建築建模
資料：
- 地理空間網格詳細資訊；
- 「BIM 執行計劃」；
- 牆壁樣式圖；
- 地板樣式圖；
- 建築平面圖、立面圖、剖面圖和詳細圖紙。

必要工作：
☐ 建立建築工作集；
☐ 將地理空間網格納入建築專案資訊模型中的協調／連結工作；
☐ 製作牆壁和地板樣式圖；
☐ 製作建築建模；
☐ 將建築專案資訊儲存到 CDE；
☐ 根據要求的標準和 BIM 執行計劃，繪製視圖和展示（屬於判斷部分）。

預期結果：
☐ 在 CDE 合適目錄中，將建築檔案設置為協作檔案；
☐ 根據「BIM 執行計劃」的要求，建立工作集；
☐ CAD 地形測量與建築模型的正確連結；
☐ 建立牆壁樣式；
☐ 建立地板樣式；
☐ 建立建築層級；
☐ 將結構網格複製到建築專案模型中；
☐ 平面圖、立面圖、剖面圖和詳細圖紙；
☐ 將建築專案檔案儲存於 CDE 中，以供其他專業領域的人員使用。

第二天（三個小時）－結構建模
資料：
☐ 結構網格圖的詳細資訊；
☐ 完成的鋼結構圖紙詳細資訊；
☐ 「BIM 執行計劃」。

必要工作：
☐ 建立結構工作集；
☐ 建立結構層次；
☐ 將地理空間網格納入結構專案資訊模型中的協調／連結工作；
☐ 建立結構網格；
☐ 建立結構專案資訊模型；
☐ 將結構專案資訊儲存至 CDE；
☐ 繪製視圖和展示（屬於判斷部分）。

預期結果：
☐ 結構網格圖；
☐ 結構圖；
☐ 將結構專案文件儲存至 CDE 中，以供其他專業領域的人員使用。

第二天（三個小時）－BIM 協調
資料：
☐ 完成的結構模型和建築模型；
☐ 其他專業領域的模型；
☐ 「BIM 執行計劃」。

必要工作：
☐ 製作聯合模型；
☐ 對聯合模型執行一系列的檢查；
☐ 報告並分派在 CDE 中發現的問題。

預期結果：
☐ 聯合結構、建築和其他專業領域專案模型；
☐ 聯合模型的硬衝突檢測；

☐ 藉由在 CDE 主模型中「四處走動」，以確保聯合專案模型的品質；
☐ 向 CDE 報告和分派問題。

第三天（六個小時）－校正模型與資料提取
資料：
☐ 業主要求更改模型；
☐ 結構模型和建築模型；
☐ 命名與術語；
☐ 所有必要的附加資訊。

要求的工作：
☐ 修改模型；
☐ 為問題提供解決方案；
☐ 使結構化資產資料符合現今標準；
☐ 提供資料時程表；
☐ 繪製視圖和展示（屬於判斷部分）。

預期結果：
☐ 業主要求的結構和建築結構模型更改；
☐ 對於業主強調的問題，提出具創意的解決方案；
☐ 聯合模型之結構資產的「資料交換」；
☐ 具有自訂欄位與關聯視圖的數據計畫表；
☐ 標註尺寸的平面圖，帶有選定元件的標記數據；
☐ 聯合模型的立面圖，帶有選定元件的標記數據。。

第四天（四個小時）－視覺化
資料：
☐ 完整的聯合模型；
☐ 業主視覺化要求；
☐ BIM 執行計劃。

必要工作：
☐ 製作照片著色圖像；
☐ 製作聯合模型的內部和外部動畫；
☐ 為聯合模型的業主提供VR體驗。
預期結果：
☐ 外部和內部著色圖像；
☐ 外部和內部動畫；
☐ 外部和內部 VR 體驗。

5.4 Test Project development 制定試題

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.

所提的試題必須使用WorldSkills組織提供的格式(www.worldskills.org/expertcentre)，文字檔使用Word格式，圖檔使用DWG格式。

5.4.1 Who develops the Test Project or modules 由誰設計試題或模組

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

試題／模組是由一位獨立的出題專家與職類經理合作所設計。

5.4.2 **When is the Test Project developed** 何時設計試題

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

試題／模組的設計係根據如下時程表所定：

Time 時間	Activity 活動
Six (6) months before the current Competition 本屆競賽前六（6）個月	The Test Project is to be developed. 設計試題。
One (1) month before the Competition 競賽前一（1）個月	The Test Project must be submitted to WorldSkills Skills Competitions Administration Manager. 試題必須提交WorldSkills技能競賽行政經理確認。
At the Competition 競賽期間	The Test Project modules are presented to Experts and Competitors. 將試題模組提供給裁判與選手。

5.5 Test Project initial review and verification 試題初審與驗證

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.

試題的目的在於為選手創造挑戰，以能真實地代表在一種經認定的職業之中，其傑出從業人員的工作生活。 為了達到此目的，試題將會應用評分方案，並完全代表WSOS，也因此，試題不論是在脈絡、目的、活動與期望各方面，都有其獨特性。

為了支援試題的設計和開發，已建立了一套嚴格的品質保證和設計流程（請參閱《競賽規則》第10.6-10.7節。）待WorldSkills核准之後，獨立的試題出題專家即應確定一位或多位獨立的專家及可信賴的個人，先審查出題專家的想法和計劃，接著驗證試題，最後再確認試題。

技術顧問將基於競賽規則第10.7節所述的風險分析考量，確保並協調此工作安排，以保證初審與驗證的及時性與完整性。

5.6 Test Project validation 確認試題

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.

職類經理負責協調確認試題，並確保試題／模組可在選手的材料、設備、知識與時間限制內完成。

5.7 Test Project selection 選擇試題

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

試題／模組由獨立的出題人與職類經理合作選出。

5.8 Test Project circulation 公布試題

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.

如適用公布試題，則試題將透過如下方式在網站上公布：

競賽前不公開試題／模組，在每個模組的競賽要開始之前，才會向選手宣布試題／模組。

5.9 Test Project coordination (preparation for Competition) 協調試題（競賽準備）

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

試題／模組的協調工作係由職類經理所負責。

5.10 Test Project change 更動試題

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.

競賽時無須對試題／模組進行30%的更動，而對試題文件及場地設備表限制中的技術錯誤進行修改，則屬例外情況。

5.11 Material or manufacturer specifications 材料或原廠規格

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.

供選手完成試題的特定材料及／或原廠規格，將由競賽主辦國提供，相關資訊請見 www.worldskills.org/infrastructure 的「裁判中心」。但請注意，在某些情況下，特定材料及／或原廠規格的細部資訊可能仍須保密，不會在競賽前公布， 這樣的品項也可能包括屬於挑錯或是不公開試題模組的品項。

6 Skill management and communication
技能管理與溝通

6.1 Discussion Forum 論壇

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.

在競賽前，所有關於此職類的討論、溝通、合作及決定，均須於論壇上 (http://forums.worldskills.org)進行，與職類有關的決定與溝通，經論壇議定者方屬有效。裁判長 （或經裁判長所指派的裁判）為此論壇的仲裁者。請參照「競賽規則」中溝通及競賽設計發展要求的時程規定。

6.2 Competitor information 提供給選手的資訊

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

提供給已報名選手的所有資訊，皆可見於網站中的「選手中心」 (www.worldskills.org/competitorcentre)。
這些資訊包括有：

- 競賽規則
- 技術說明書
- 評分總表（如適用）
- 試題（如適用）
- 場地設備表
- WorldSkills衛生安全與環境政策規章
- 其他與競賽有關的資訊

6.3 Test Projects [and Marking Schemes] 試題〔及評分方案〕

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

已公布的試題可見於www.worldskills.org/testprojects及「選手中心」 (www.worldskills.org/competitorcentre)。

6.4 **Day-to-day management** 每日管理

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).

「技能管理計畫」裡有每日管理的相關規定，此計畫是由職類經理帶領的技能管理小組所訂定。技能管理小組的成員為職類經理、裁判長及副裁判長。技能管理計畫自競賽開始前六個月逐步制定，之後於競賽期間經裁判們同意而底定。技能管理計畫可於網站上的「裁判中心」處 (www.worldskills.org/expertcentre)下載讀取。

6.5 General best practice procedures 一般最佳實務程序

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.

一般最佳實務程序清楚地描述了最佳實務程序和職類特定規則之間的差別（第9節）。一般最佳實務程序是指不能以違反競賽規則或職類特定規則為由，來追究裁判和選手之責任的程序，違規行為將循包含「道德與行為處罰制度」在內的「事件與爭議處理」程序進行處罰。 在某些情況之下，一般最佳實務程序可能也會在評分方案裡反映出來。

Topic/task 主題／任務	Best practice procedure 最佳實務程序
Equipment failure 設備故障	• 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. • 設備故障時，選手必須立刻舉手通知裁判，裁判會將選手無法使用設備的時間記錄下來，而因設備故障而損失的任何時間，將在標準模組時間結束時，補給選手。至於在 設備故障之前未儲存的工作，將不會給予額外的補償時間。
Communication and contact between compatriot Expert and Competitor 同國裁判與選手的溝通和聯繫	• 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. • 裁判／翻譯與選手在休息時間或午餐時間皆不得溝通。 • 選手與同國裁判／翻譯不得同時在競賽區外，除非經裁判長同意。

7 Skill-specific safety requirements 職類特定安全要求

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

請參照WorldSkills衛生安全與環境政策法規中關於地主國或區域法規的規定。

Task 任務	Sturdy shoes with closed toe and heel 前後腳跟都有包覆的 結實鞋子
General PPE for safe areas 安全區域的一般個人防護裝備	√
Competitor workstations 選手工作區	√

8 Materials and equipment 材料與設備

8.1 Infrastructure List 場地設備表

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.

場地設備表會列出所有設備、材料及競賽主辦國提供的設施。

場地設備表的資料可見於www.worldskills.org/infrastructure。

場地設備表會列出技能管理小組對下屆競賽所要求的品項及數量，競賽主辦國會逐步更新場地設備表，列出這些品項的確實數量、類別、品牌及型號。請注意，在某些情況下，特定材料及／或原廠規格的細部資訊可能仍須保密，不會在競賽前公布，這樣的品項也可能包括屬於挑錯或是不公開試題模組的品項。

競賽主辦國供應的品項會另列一欄。

在每一屆的競賽，技能管理小組須審視及更新場地設備表，供下屆競賽之用。如有要求增加空間及／或設備，則技能管理小組必須通知技能競賽主任。

每一屆競賽時，技術觀察員必須審查該屆競賽所使用的場地設備表。

場地設備表不包括要求選手及／或裁判必須攜帶的品項，亦不包括選手們不能攜帶的品項 — 茲說明如下。

8.2 Competitors toolbox 選手工具箱

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

選手不得寄送工具箱至競賽場，所有工具皆將由競賽主辦國提供。

8.3 Materials, equipment, and tools supplied by Competitors 選手提供的材料、設備及工具

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.

選手可攜帶下列品項至競賽場：

- 標準彙編手冊；
- 技術手冊；
- 手繪草圖器具；
- 量測器具；
- 個人鍵盤和滑鼠（包括驅動程序），如果與主辦會員國所提供者不同；
- 允許使用「Space Mouse」（3D滑鼠），如 有不同的電子設備，必須交由裁判小組確認。

選手須自行提供第7節職類特定安全要求中所列的個人防護裝備。

8.4 Materials, equipment, and tools supplied by Experts
裁判提供的材料、設備及工具

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.

裁判無須攜帶材料、設備或工具，所有品項皆將由競賽主辦國提供。

裁判須自行提供第7節職類特定安全要求中所列的個人防護裝備。

8.5 Materials and equipment prohibited in the skill area
禁止在職類區域內使用的材料及設備

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

選手與裁判不得攜帶任何未列在第8.3及8.4節的材料或設備。

8.6 Proposed workshop and workstation layouts
工作區及工作站平面配置提議

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

Example workshop layout

前幾屆競賽的工作區平面配置圖可見於www.worldskills.org/sitelayout。

工作區平面配置範例：

9 Skill-specific rules 職類特定規則

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.

職類特定規則不得牴觸或優於競賽規則,其規範了各職類可能各不相同的特定細節,包括如下物品與事項的規定,但不僅限於此:個人資訊科技設備、資料儲存裝置、網路進出權限、程序、工作流程、文件管理及發送等規定。如有違反這些規則的行為發生,將根據包含「道德與行為處罰制度」在內的「事件與爭議處理」程序解決。

Topic/task 主題／任務	Best practice procedure 最佳實務程序
Use of technology – USB, memory sticks 使用科技產品－USB、記憶卡	• 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. • 不得在競賽場的電腦接上任何外接記憶裝置,除非是在裁判長與副裁判長的監督之下。 • 選手不得將任何數位資料上載至其競賽場的電腦。
Use of technology – personal laptops, tablets, and mobile phones 使用科技產品－個人筆電、平板及手機	• 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. • 職類經理、裁判長、副裁判長及翻譯僅能在裁判室裡使用個人筆電、平板及手機。 • 選手不得將個人筆電、平板或手機帶入工作區。如果有帶入這些品項,則會鎖在個人置物櫃裡,待一天結束後才能取出。 • 不得使用無線耳機。
Use of technology – personal photo and video taking devices 使用科技產品－個人拍照與攝影裝置	• During module three the use of personal photo and video taking devices is forbidden in the workshop. • 在進行模組三的競賽時,禁止在工作區使用個人拍照與攝影裝置。

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.
圖紙、錄製資訊	• 不論在任何情況之下，選手皆不得將筆記帶入工作區，選手在其工作區所做的所有筆記，僅能一直留在選手桌上，在C4日競賽結束之前，所有筆記皆不得帶離工作區。

10 Visitor and media engagement 觀眾及媒體參與

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.
-

為了吸引更多觀眾並讓媒體充分參與，可考慮如下幾種方法：
- 試做
- 顯示幕
- 試題說明
- 加強對選手活動的瞭解程度
- 選手簡介
- 就業機會
- 每日競賽實況報導
- 虛擬實境體驗
- 贊助廠商攤位

11 Sustainability 永續性

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.
-

此職類將注重如下維護永續性的作法：

- 回收利用
- 使用「綠色」材料
- 在競賽結束後，讓完工的試題作品有得利用。
- 使用數位資訊，減少用紙。

12 References for industry consultation 產業諮詢參考

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.

WorldSkills致力於確保WorldSkills職業標準能充分體現國際公認的產業與行業最佳實務，為此目的，WorldSkills每兩年皆會與全球數家機構組織接洽，請其針對相關角色說明及WorldSkills職業標準提供回饋意見。

與此同時，WSI查閱了三個國際職業分類和數據庫：

- 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/)

為了2021年WorldSkills上海相關角色說明與和WorldSkills職業標準，有與下表所列出的組織接觸，請其提供寶貴的回饋意見。

Organization 機構組織	Contact name 聯絡人姓名
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.