worldskills Ireland

DIGITAL INFRASTRUCTURE DESIGN

Proposed Competition

MAY 1, 2024

Document prefix

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:

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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

Digital Infrastructure Design

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

Modern, safe and adequate infrastructure is the backbone of functioning Societies around the world.

With an expected population growth from 7 to 10 billion people by 2050, 400.000 people moving to cities every day, globalization and climate change we are in an era of change.

The biggest challenges for countries around the world will be to maintain existing infrastructure and build new Infrastructure to support the globalization and modern ways of transportation emerge e.g. Autonomous Cars, Hyperloop. This supports the UN Strategic Development Goals SDG 11 Sustainable Cities and Communities and 12 Responsible Production and Consumption.

In 2016 the American Society of Civil Engineers estimated that the United States had an unfunded infrastructure gap of more than $2 trillion. On the other hand McKinsey suggests that currently 40 percent of global infrastructure and capital project investment is poorly spent because of bottlenecks, lack of innovation, and market failures. The competition would direct positive action towards SDG 9 Industry, Innovation and Infrastructure.

In order to achieve this governments around the world, have introduced digital mandates and initiatives to improve and create infrastructure over the coming years and decades. Using an intelligent 3D project model, one can rapidly produce conceptual designs for any infrastructure project and evaluate different options in planning and preliminary design phases. The software has embedded tools that enable a rich contextual setting, allowing one to explore various design options and perform analysis and simulations with vivid visualisations. This will result in an improved delivery of project design objectives and outcomes. Not only will it benefit the project deliverables, but it will mitigate the risks of cost and schedule overruns during construction.

1.1.3 Number of Competitors per team

Digital Infrastructure Design is a Single Competitor skill competition.

1.1.4 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.

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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.

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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.

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2.2 WorldSkills Occupational Standards

1	**Points and Sorting**	**10**

The individual needs to know and understand:
- Point creation tools
- The import point dialogue box
- Points panorama view
- Point group properties

The individual shall be able to:
- Create points
- Import points
- Modify points
- Create point groups
- Analyse points for incorrect data

2	**Surfaces**	**20**

The individual needs to know and understand:
- The parameters and display settings of surface styles
- The surfaces build functionality, how it was constructed and how it uses the data for calculations
- Data categories of a surface definition
- Volume Dashboard Panorama
- Annotating a surface
- Surface properties dialogue box

The individual shall be able to:
- Create and edit surfaces
- Create a TIN volume surface to compare two surfaces
- Create surface labels
- Edit a surface for incorrect data
- Create a surface analysis
- Output information from the statistic tab within surface properties dialogue box

3	**Alignments & Profiles**	**20**

The individual needs to know and understand:
- Alignment layout dialogue box
- Alignment layout tools
- Alignment layout parameter view
- Offset alignments
- Widenings within offset alignments

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- Alignment from objects
- Annotating alignments
- Layout profiles
- Profile Views
- Profile parameters
- Superelevation tabular editor
- Sight distance

The individual shall be able to:
- Create an alignment
- Add free, fix and floating curves and lines to an alignment
- Add spiral curves
- Create alignments from objects
- Create offset alignment including widenings
- Create an alignment label displaying different alignment information
- Create a profile view
- Create/edit profiles
- Add superelevation critical stations
- Create a sight distance report

4	**Assemblies & Corridors**	**20**

The individual needs to know and understand:
- Assemblies
- How to find and use the tool palette
- Corridor dialogue box
- Edit targets
- Edit frequency

The individual shall be able to:
- Create an assembly
- Apply different subassemblies to the assembly
- Make active the superelevation of a subassembly
- Create a corridor
- Create a corridor surface
- Edit targets of a corridor both vertically and horizontally
- Analyse the corridor surface to ensure assemblies and superelevation are applied correctly

5	**Volume**	**15**

The individual needs to know and understand:
- Sample Lines
- Section Views
- Compute Materials
- Volume Reports

The individual shall be able to:
- Create sample line at specific intervals.

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INSERT SKILL NAME

- Adjust the width of the sample lines
- Create section views
- Add information to the section views
- Add material to the section views
- Create a volume report
- Modify the information and styles in section views

6	**Pipe Network and Clash Detection**	**15**

The individual needs to know and understand:

- Pipe Network layout
- Pipe Network parameters
- Pipes and Structures
- Parts Catalogue and part list
- Clash Detection
- Hydrodynamic Modelling

The individual shall be able to:

- Create a pipe network with both pipes and structures
- Apply different part sizes to the network
- Swap parts of the network
- Add network to profile view
- Modify networks
- Use the pipe network vista.
- Use a hydrology software (e.g. SSA)
- Run a clash detection.
- Resolve clashes.

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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.

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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 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.

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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

SAMPLE OF TABLE FROM CIS

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.)

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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.

[INSERT TEXT HERE]

4.10 Skill assessment procedures

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

Module 1 – Road Design

- Importing data
- Sorting through the data and deleting any incorrect information
- Creating point groups
- Create a surface from the different file types
- Edit the surface to a boundary line and get rid of any anomalies
- Find the length of a contour line
- Place spot elevation labels at a specific coordinates

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- Find the area of a specific slope range
- Create an alignment and profile
- Give an instantaneous slope label at a specific chainage within a profile
- Create a corridor to a defined assembly
- Apply superelevation to the alignment and corridor
- Create a corridor surface
- Create a junction
- Create a sight distance report
- Create drawings

Module 2 - Pipe Network and Drainage Models

- Create topographical surfaces.
- Places pipes and structures in certain locations
- Extract the information from the pipe network such as invert, crown, diameter etc.
- Add networks to profiles.
- Create Plan and Profile drawings.
- Create parcels for the dwelling area.
- Create a storm sewer network.
- Export the storm sewer to SSA and check design.
- Create the attenuation pond.
- Create the drawings.

Module 3 – Volume & Clash Detection

- Create topographical surfaces.
- Create alignments, profiles, and sample lines.
- Generate a volume report between specific chainages.
- Create volumetric surfaces.
- Create drawings.
- Generate clash detection report
- Resolve clashes

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5 The Test Project

5.1 General notes

Sections 3 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

- 1.0 Road design
- 2.0 Pipe Network
- 3.0 Volumes

5.3 Test Project design requirements

1.1 Importing data and surfaces

Data:

- Client Brief
- CSV file
- DWG file
- Short questions

Work requested:

- Import the CSV information. Ensure that all information imports correctly and delete any corrupt information.

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- Create point groups
- Create a surface from the point file
- Create a surface from the DWG file

Results expected:

- 2D and 3D areas of the surfaces
- Slope and spot elevation at specific locations
- A volumetric surface
- Extraction of contour lines

1.2 Alignment, profiles, and corridors

Data:

- Client brief
- DWG file with alignments and profile
- Short questions

Work Requested:

- Create an alignment in the exact position shown in the drawing
- Create a profile to the same geometry shown in the drawing
- Apply superelevation to the alignment as described in the brief
- Create assemblies with the subassemblies defined in the brief
- Create a corridor
- Target the corridor to alignments and feature lines both horizontally and vertically
- Create a corridor surface
- Create a junction
- SSD report
- Create Plan and Profile drawings

Results expected:

- Alignment geometry information from the panorama view
- Profile geometry information from the panorama view
- One point slope labels showing that the superelevation is applied correctly
- Volumetric surface showing that the corridor was created correctly
- Chainages where visibility drops below a certain range

2.0 Pipe Network:

Data:

- Client brief
- DWG file showing the site
- Short questions

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Work Requested:

- Create a pipe network from an object
- Create a pipe network from layout tools
- Change parts within a network
- Modify network to specific elevation
- Create a hydrology model
- Create drawings.

Results expected:

- Insertion rim elevation values
- Invert centre and crown elevation values
- 2D/3D lengths
- Flows and capacities
- Plan and Profile Drawings

3.0 Volumes & Clash Detection

Data:

- Client brief
- DWG file that has corridor, alignments, objects and surfaces
- Short questions

Work Requested:

- Create sample lines at specific intervals and widths
- Create section views
- Modify view group properties
- Add more sources into the section views
- Project objects to views
- Generate a volume report using the two surface quantity takeoff criteria
- Generate a volume report using the road construction takeoff criteria
- Generate a clash detection report

Results expected:

- Specific information from the proposed and existing levels and offset bands
- Invert level of a pipe projected onto the section view
- The volume at specific section views between finished road level and existing
- The volume at specific section views of the verge
- The volume between specific section views of the earthwork place
- Create heat maps
- Identify and resolve clashes

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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

Test Project developed by Industry

5.4.2 When is the Test Project developed

The Test Project is developed according to the following timeline:

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 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

[INSERT TEXT HERE]

5.8 Test Project circulation

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

[INSERT TEXT HERE]

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5.9 Test Project coordination (preparation for Competition)

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

5.10 Test Project change

If applicable.

[INSERT TEXT HERE]

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.

Software needed:

- Civil 3D
- Civil 3D Storm and Sanitary Analysis
- Navisworks

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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.

Here you may wish to include:

- The process of and timing of the release of modules of an uncirculated Test Project

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- The process of and timing for the translation of the Test Project
- The tools that an Interpreter can use for the translation process such as dictionary, Internet, translation devices, etc.
- Who can attend to a Competitor and when?

[INSERT TEXT HERE]

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7 Skill-specific safety requirements

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

[INSERT TABLE OF SKILL-SPECIFIC PERSONAL PROTECTIVE EQUIPMENT (PPE)]

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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

Specify here the maximum outside size of the toolbox in volume, e.g. 0.75 m^3 (wheels not included). This size should not include the outside packing used to transport the toolbox. Any other special requirements of the toolbox must be specified here, for example the number allowed.

8.3 Materials, equipment, and tools supplied by Competitors

[INSERT TEXT HERE]

8.4 Materials, equipment, and tools supplied by Experts

[INSERT TEXT HERE]

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8.5 Materials and equipment prohibited in the skill area

[INSERT TEXT HERE]

8.6 Proposed workshop and workstation layouts

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

Example workshop layout

[INSERT LAYOUT FROM PREVIOUS COMPETITION HERE]

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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.

Use of technology – USB, memory sticks	•
Use of technology – personal laptops, tablets and mobile phones	•
Use of technology – personal photo and video taking devices	•
Drawings, recording information	•
Equipment failure	•
Health, Safety, and Environment	•
Infrastructure	•
Supervision of Competitors	•

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10 Visitor and media engagement

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

[INSERT TEXT HERE]

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11 Sustainability

This skill competition will focus on the sustainable practices below:

[INSERT TEXT HERE]

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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:

2142.1 civil engineer (ESCO https://ec.europa.eu/esco/portal/home)
Civil engineers design, plan, and develop technical and engineering specifications for infrastructure and construction projects. They apply engineering knowledge in a vast array of projects, from the construction of infrastructure for transportation, housing projects, and luxury buildings, to the construction of natural sites. They design plans that seek to optimise materials and integrate specifications and resource allocation within the time constraints.

- adjust engineering designs
- approve engineering design
- ensure compliance with safety legislation, local standards & work requirements
- perform scientific research
- use technical drawing software

Optional Skills:

- record survey measurements
- read standard blueprints
- process collected survey data
- perform project management
- oversee construction project
- operate surveying instruments
- design transportation systems
- create ~~AutoCAD~~ Civil3D drawings
- apply health and safety standards
- manage a team

- Surveying and Mapping Technicians

- Architectural and Civil Drafters
-

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

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Organization	
Atlantic Technological University	Tommy Coyne, Lecturer - Department of Building and Civil Engineering
Atlantic Technological University	Gerard Nicholson, Lecturer – Department of Building and Civil Engineering
RPS	Mark Costello, Director, Digital Design, BIM & Technical Services
Autodesk	Philipp Mueller, Construction Program Manager, EMEA, Autodesk Education Experiences

RPS – History

RPS, a Tetra Tech Company

Founded in 1970, RPS is now part of Tetra Tech, a leading provider of consulting and engineering services worldwide. Our experts define, design and manage projects that create shared value to a complex, urbanising and resource-scarce world. We have deep expertise in things that matter and we are easy to work with. Our clients trust us and we are respected for our creative thinking. Together we build strong relationships by repeatedly delivering on our promise. With 28,000 associates in 550 offices in more than 100 countries on 7 continents, Tetra Tech has the resources of a multi-billion-dollar company and can move at the speed of a 20-person office.

We work across twelve service clusters: project and program management, design and development, water services, environment, advisory and management consulting, exploration and development, planning and approvals, health, safety and risk, oceans and coastal, laboratories, training and communications, creative and digital services. These services are augmented by the wider global capabilities and expertise of the Tetra Tech business.

RPS – Contributions to Publications/Academia

- The Handbook of Research on Driving Transformational Change in the Digital Built Environment
- The Evolving Integration of BIM Into Built Environment Programmes in a Higher Education Institute
- Award winning Higher Diploma in Engineering in Building Information Modelling

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Autodesk

Autodesk is a leader in Design, Engineering Construction, Manufacturing and Media & Entertainment Software supporting Industry professionals around the world to design, imagine and create a better world. Over four decades Autodesk worked together with our customers to transform how things are made. Today our solutions empower innovators everywhere to combine technologies in new ways, unleash talent, and unlock insights to make the new possible.

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