CONSTRUCTION AND BUILDING TECHNOLOGY

Concrete Construction Work

Technical Description

 TD46 v8.0 WSC2021

worldskills

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

The Technical Description consists of the following:

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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

Concrete Construction Work

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

A Concrete Construction Worker generally works on commercial and residential projects. There is a direct relationship between the nature and quality of the product required and the payment made by the customer. Therefore, the Concrete Construction Worker has a continuing responsibility to work professionally in order to meet the requirements of the customer and thus maintain and grow the business.

Concrete Construction Work is closely associated with other parts of the construction industry, and with the many products that support it, normally for commercial purposes.

The Concrete Construction Worker works internally and externally, including on the homes of customers and on building sites, in all weather conditions and on small and major projects. They will interpret drawings, set out, measure, and construct which includes formwork, reinforcement and concrete, and finish to a high standard.

Work organization and self-management, communication and interpersonal skills, problem solving, innovation and creativity, working accurately are the universal attributes of the outstanding construction practitioner. The Concrete Construction Worker works in a team. Each team member takes on a high degree of personal responsibility and autonomy.

From working safely and tidily with resilience and endurance through to exceptional planning and scheduling, concentration, precision, accuracy, and attention to detail to achieve an excellent finish, every step in the process matters and mistakes are largely irreversible and very costly.

With the international mobility of people, the construction practitioner faces rapidly expanding opportunities and challenges. For the talented Concrete Construction Worker there are many commercial and international opportunities; however, these carry with them the need to understand and work with diverse cultures and trends. The diversity of skills associated with concrete and formwork is therefore likely to expand.

1.1.3 Number of Competitors per team

Concrete Construction Work is a team skill with two Competitors per team.

1.1.4 Age limit of Competitors

The Competitors must not be older than 22 years in the year of the Competition.

1.2 The relevance and significance of this document

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

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

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

1.3 Associated documents

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

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

2 The WorldSkills Occupational Standards (WSOS)

2.1 General notes on the WSOS

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

The skill competition is intended to reflect international best practice as described by the WSOS, and to the extent that it is able to. The Standard is therefore a guide to the required training and preparation for the skill competition.

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

The Standard is divided into distinct sections with headings and reference numbers added.

Each section is assigned a percentage of the total marks to indicate its relative importance within the Standards. This is often referred to as the "weighting". The sum of all the percentage marks is 100. The weightings determine the distribution of marks within the Marking Scheme.

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

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

2.2 WorldSkills Occupational Standards

Section		Relative importance (%)
1	**Work organization and management**	5

The individual needs to know and understand:

- Health and safety legislation, obligations, and documentation
- The situations when personal protective equipment must be used
- The purposes, uses, care, maintenance, and storage of all tools and equipment together with their safety implications
- The purposes, uses, care and storage of materials
- Sustainability measures applying to the use of "green" materials and recycling
- The ways in which working practices can minimize wastage and help to manage costs
- The principles of workflow and measurement
- The significance of planning, accuracy, checking, and attention to detail in all working practices

The individual shall be able to:

- Follow health and safety standards, rules, and regulations
- Identify and use the appropriate personal protective equipment including safety footwear, ear, and eye protection
- Select, use, clean, maintain, and store all tools and equipment safely
- Select, use, and store all materials safely
- Work safely at heights
- Plan work areas to maximize efficiency and maintain the discipline of regular tidying
- Measure accurately
- Work efficiently and check progress and outcomes regularly
- Establish and consistently maintain high quality standards and working processes
- Set up and make secure construction sites by means of locks and signage, and implement anti-theft measures
- Proactively engage in continuous professional development to maintain current knowledge of technology and working practices

Section		Relative importance (%)
2	**Communication and interpersonal skills**	5

The individual needs to know and understand:

- The significance of establishing and maintaining confidence with colleagues and clients
- The roles and requirements of architects and other related professions
- The value of building and maintaining productive working relationships
- The importance of swiftly resolving misunderstandings and conflicting demands
- The criteria for being understandable within teams and to non-specialists
- The principles of self-awareness and awareness of others
- The basic rules of communication

The individual shall be able to:

- Interpret customer requirements and manage customer expectations positively
- Recognize the needs of architects and other related professions
- Introduce architects and related trades and professions to support customer requirements
- Use comments and questions to help solve problems
- Formulate technical questions and explain problems
- Offer suggestions for solving technical problems
- Respond to colleagues' ideas and suggestions constructively and help make decisions on them
- Describe complex technical matters to non-specialists

3	**Interpretation of drawings**	10

The individual needs to know and understand:

- The essential information that must be included in construction drawings
- Principles, symbols, and protocols used in construction drawings
- The importance of checking for missing information or errors, anticipating problems and resolving in advance of the "setting out" process and construction
- The role and use of geometry in construction processes
- Mathematical principles, processes, and problem solving
- The standardized representation of structural components in outline and in section and dimensioning (determination of heights from set measuring points)

Section		Relative importance (%)
	The individual shall be able to: • Prepare site measurement drawings • Prepare the materials requirements, taking into account increased requirements due to compression, wastage, breakage, etc. • Calculate formwork surfaces and materials requirements • Calculate formwork surfaces and materials requirements for face concrete formwork • Interpret, analyse, and work with construction plans (e.g. design plans, formwork plans, reinforcement plans, detail drawings, etc.), and material and parts lists • Relay information in plans to other professionals, work colleagues, and clients • Prepare sketches from the necessary perspectives, sections, and other representation formats	
4	**Setting out and measurement**	15
	The individual needs to know and understand: • The importance of thinking "top down" to ensure all features can be set out at the start of projects • The implications for businesses/organizations of not setting out correctly • The templates/building aids which may be helpful for construction • Calculations to assist in measurement and checking projects • Geometry principles and techniques to assist with projects	
	The individual shall be able to: • Visualize and think through projects, identifying potential challenges early and taking the necessary preventative action • Set out the locations, starting points and lines of projects according to plans and specifications • Accurately interpret dimensions from drawings and ensure designs are set out within a given tolerances • Check all horizontal and vertical angles • Produce any templates/building aids that may be helpful when constructing • Set out datum points of reference for projects • Carry out setting out work using the necessary surveying equipment (pocket rule, tape measure, distance meter, set square, level, etc.) • Set out and check angles • Create horizontal levels and measure heights using spirit levels, water level gauges, and optical devices • Set out and measure up formwork manually from plans • Measure predetermined structures, joints, and materials for the subsequent face concrete surfaces (anchor holes, shuttering frames, board inserts, distribution, and alignment of formwork boards, etc.)	

Section		Relative importance (%)
5	**Construction of formworks and reinforcement**	**40**

The individual needs to know and understand:

- The impact of Health, Safety, and Environment requirements and legislation on projects
- How to use and apply tools, equipment, construction machinery, and working aids (e.g. instruments, measuring devices, etc.) in accordance with operating and handling instructions
- How to use and handle manual tools such as hammers, saws, planes, etc., to work with materials such as wood, metal, and plastic
- How to use and handle machinery such as drills, saws, sanders, etc., to work with materials such as wood, metal, and plastic, in compliance with safety guidelines
- Scaffolding requirements
- The individual formwork components such as form lining (plywood, frame elements, screed protection cover), formwork girders, formwork supports, bolts, formwork clamps, and bracing
- The components (formwork girders, tubular steel props, supports, bracings, reinforcements, formwork anchors) and materials (wood, steel) for scaffolding
- How to make formwork, including erection, bracing, forming recesses, and stripping formwork
- Types of formwork, areas of use and usage methods for foundation formwork, wall formwork, column formwork, beam formwork, slab formwork, staircase moulds, formwork for face concrete, climbing formwork, sliding formwork, recesses, etc.
- Strengthening steel and reinforcement, categories, and types of strengthening steel plus their designations, categorizations, and delivery forms
- Cutting steel and bending steel bars according to standard specifications
- Concrete coverings
- The various types of joint (expansion joints, settling joints, construction joints, and dummy joints), what they do and how they are made
- Face concrete surfaces, in terms of porosity, colour consistency, smoothness, creation of construction joints, formwork element joints, formation of edges, impressions due to the attachment of formwork lining, anchor points, anchor hole separation, frame impression, formwork lining joints, formwork lining as a smooth or rough concrete surface (texture)

Section	Relative importance (%)

The individual shall be able to:

- Work manually with materials such as wood, metal, and plastic (for separating, reshaping, connecting)
- Measure, lay out and cut wood and work with it manually and using machinery
- Make simple trestles, working platforms plus auxiliary equipment, set up protective nets and use them in compliance with the relevant regulations
- Make and put together every type of formwork
- Make supports and reinforcements (concrete pressure)
- Make face concrete formwork
- Make slits, apertures, openings, and recesses
- Move anchors as directed
- Make various joints in combination with the appropriate joint sealants (profiles, sealing strips, expansion joint tapes)
- Cut to length, bend, interweave, lay, and anchor structural steel according to bending and reinforcement diagrams and in compliance with reinforcement directives (specifically those concerning bending, radius of curvature, end hooks, brackets, distributors, separators, joints, and connection reinforcements)
- Prevent the following problems through correct construction:
- Build-up of rust stains on vertical components and of traces of rust caused by reinforcement residues being left on the undersides of horizontal components
- Mortar residues running down through unsealed construction joints on vertical components
- Unclean edge formation due to damaged, misaligned, and unsuitable triangular or trapezoidal profiles
- Offset beyond a given standard between formwork element joints and component connections
- Heavy bleeding at formwork board and element joints and on component connections and anchor holes (e.g. core structure exposed as a result of cement paste leakage)
- Very noticeable entrainment water effects
- Differing surface qualities (colour/texture) due to inappropriately stored formwork
- Use scaffolding appropriately and safely and apply health and safety requirements and legislation

Section		Relative importance (%)
6	**Filling of formworks and treatment**	**20**

The individual needs to know and understand:

- The impact of health and safety requirements on projects
- Concrete technology and concrete processing on construction sites (ordering, transporting to formwork, application and compression, after-treatment)
- Concrete additives such as concrete liquefiers, plasticisers, sealants, anti-freeze, hardening accelerators, etc.), how to use them and their effect on the concrete
- How to prevent problems
- Additional measures to take when concreting in summer and winter
- Pre-requisites for concrete application, such as the removal of contaminants from the formwork, pre-wetting, checking for stability, using sufficient separators, smoothing gauges, etc.)
- The compression process according to the consistency of the concrete
- The possibilities of processing concrete surfaces by smoothing/removing/levelling, and the tools required to do this
- The need for after-treatment of the concrete (to counter drying-out, temperature differential, frost, leaching, vibrations) using covers, spray, humidification, use of after-treatment aids or by leaving fresh concrete in formwork beyond the stripping times
- Face concrete surfaces in terms of porosity, colour consistency, etc.

The individual shall be able to:

- Produce unreinforced and reinforced concrete (mix and transport formula concrete = site-mixed concrete)
- Order ready-mixed concrete for the site and transport it using concrete pumps, crane buckets, or conveyors
- Apply means of separation before concreting, depending on the formwork lining, using high pressure sprays, brushes, cloths, or mechanically
- Apply concrete in prepared formwork
- Compress concrete using various compressors
- Process concrete surfaces by smoothing/removing/levelling, using the tools required to do this
- Carry out after-treatment of concrete using covers, spray, humidification, use of after-treatment aids, or by leaving fresh concrete in the formwork beyond the stripping times
- Prevent incorrect application and compression of concrete ("honeycombing", highly visible layers, etc.), by ensuring correct construction.

Section		Relative importance (%)
7	**Removal of formworks and reprocessing**	5
	The individual needs to know and understand: • Stripping times • The cleaning options depending on the formwork material, such as pressurized water, manual formwork cleaning • Health and safety issues and procedures relating to hazardous cleaning materials • Care and maintenance of system formwork (cleaning, maintenance, repairing damaged sections, working with separating agents)	
	The individual shall be able to: • Strip formwork using tools (e.g. formwork bars) • Clean formwork using e.g. water, manual formwork cleaners • Use hazardous cleaners correctly and safely • Care for and maintain system formwork and replace damaged sections • Sort and store all required formwork parts ready for transportation	
	Total	**100**

3 The Assessment Strategy and Specification

3.1 General guidance

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

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

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

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

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

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

4 The Marking Scheme

4.1 General guidance

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

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

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

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

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

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

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

4.2 Assessment Criteria

The main headings of the Marking Scheme are the Assessment Criteria. These headings are derived before, or in conjunction with, the Test Project. In some skill competitions the Assessment Criteria may be similar to the section headings in the Standards; in others they may be different. There will normally be between five and nine Assessment Criteria. Whether or not the headings match, the Marking Scheme as a whole must reflect the weightings in the Standards.

Assessment Criteria are created by the person or people developing the Marking Scheme, who are free to define the Criteria that they consider most suited to the assessment and marking of the Test Project. Each Assessment Criterion is defined by a letter (A-I). *The Assessment Criteria, the allocation of marks, and the assessment methods, should 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.

4.3 Sub Criteria

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

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

4.4 Aspects

Each Aspect defines, in detail, a single item to be assessed and marked, together with the marks, and detailed descriptors or instructions as a guide to marking. Each Aspect is assessed either by measurement or by judgement.

The marking form lists, in detail, every Aspect to be marked together with the mark allocated to it. The sum of the marks allocated to each Aspect must fall within the range of marks specified for that section of the Standards. This will be displayed in the Mark Allocation Table of the CIS, in the following format, when the Marking Scheme is reviewed from C-8 weeks. (Section 4.1 refers.)

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

4.5 Assessment and marking

There is to be one marking team for each Sub Criterion, whether it is assessed and marked by judgement, measurement, or both. The same marking team must assess and mark all Competitors. Where this is impracticable (for example where an action must be done by every Competitor simultaneously, and must be observed doing so), a second tier of assessment and marking will be put in place, with the approval of the Competitions Committee Management Team. The marking teams must be organized to ensure that there is no compatriot marking in any circumstances. (Section 4.6 refers.)

4.6 Assessment and marking using judgement

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

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

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

4.7 Assessment and marking using measurement

Normally three Experts will be used to assess each aspect, with a fourth Expert supervising. In some circumstances the team may organize itself as two pairs, for dual marking. Unless otherwise stated, only the maximum mark or zero will be awarded. Where they are used, the benchmarks for awarding partial marks will be clearly defined within the Aspect. To avoid errors in calculation or transmission, the CIS provides a large number of automated calculation options, the use of which is mandated.

4.8 The use of measurement and judgement

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

4.9 Skill assessment strategy

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

(Assessment specification = Test Project + Marking Scheme).

1. Prior to the Competition: Test Project proposals + Marking Scheme proposals;
2. At the Competition (C-6 to C-3): Test Project and Marking Schemes are defined;
3. Start of Competition (C-3): Test Project + Marking Scheme fully defined = Assessment Specification fully defined.

The following criteria can be assessed:

- Dimensions;
- Flatness;
- Vertical accuracy;
- Horizontal accuracy;
- Safety;
- Technical correctness;
- Execution confirming to standards;
- Visual impression.

4.10 Skill assessment procedures

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

The Experts who attend the Competition are divided into marking groups according to their WorldSkills experience, language, and culture to deal with each section of the marking criteria.

Groups of Experts assess the same aspects for all Competitors.

For assessment Experts use specific measurement points which are marked on the drawings. Measurement tools are used to take measurements at these points.

The Experts are divided into marking groups to deal with each section of the marking criteria.

Each module/task/section is completed on the assigned day so that progressive marking can take place.

The marking of modules will start when all Competitors have finished their module.

To ensure transparency, each Competitor is provided the same Mark Summary Form as used by the Experts.

A master set of marking tools provided by the Competition Organizer is available during familiarization. All measurements are taken using the master set of measuring equipment.

As per the Competition Rules a majority vote (50% +1) is needed to:

- Change the marking scheme (within limits specified in the Technical Description);
- Change Competition sequence or content;
- Agree on a solution for disputes concerning marks awarded etc.
- The assessment information is not provided to the marking group until the all Competitors have completed the work that is assessed.
- The panel of Experts will assist the Skill Management Team select the Experts for the judgement group. The selected Experts possess the suitable industry and competition experience to fulfil the role.
- Four Experts are used in the Judgement Marking Group.

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

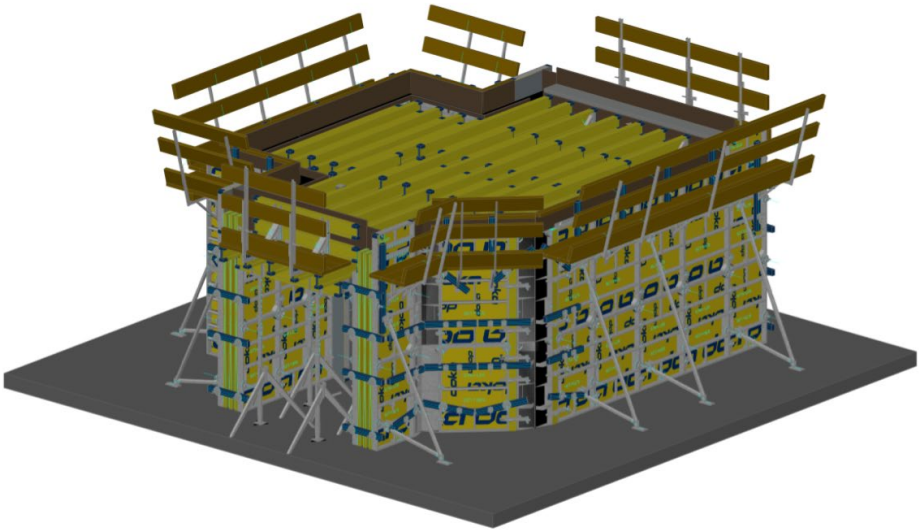
The Test Project is a single Test Project assessed in stages.

It consists of the following:

	formwork	reinforcement	concreting
WALL	YES	YES	YES
COLUMN	YES	YES/NO	NO
CELING	YES	YES	NO

5.3 Test Project design requirements

The Test Project is a modern formwork system which has to be constructed according to the supplied drawings. The Test Project shall require making a reinforcing cage. A part of the formwork is reinforced and filled with concrete due to time constraints. It shall be designed in a way that it can be constructed in four days and that separate stages can be assessed. The formwork will only be removed on the outer side to expose the quality of the final concrete surface. Components of digitization, ARVR, and BIM are acceptable for the development of the Test Project. An example for such a Test Project can be seen below:



5.4 Test Project development

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

5.4.1 Who develops the Test Project or modules

The Test Project/modules are developed independently by all Experts.

5.4.2 When is the Test Project developed

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

Time	Milestone
C-9 months	The Test Project is developed independently.
C-8 months	The Experts vote on the Test Project on the WorldSkills Discussion Forum.
C-3 months	The Test Project documents are sent to the WorldSkills International Skills Competitions Administration Manager and it is circulated on the Worldskills website.
At the Competition on C-4	The Experts develop the 30% change
At the Competition on C-2	The Test/Project modules are presented to the Competitors.

5.5 Test Project initial review and verification

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

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

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

5.6 Test Project validation

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

5.7 Test Project selection

The Test Project/modules are selected by a vote of all Experts on the WorldSkills Discussion Forum.

5.8 Test Project circulation

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

The Test Project/modules are circulated three (3) months prior to the competition.

5.9 Test Project coordination (preparation for Competition)

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

5.10 Test Project change

The Experts shall develop the 30% change as required by WorldSkills on C-4. This change is presented to Competitors on C-2.

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.

All information about the supplied materials can be viewed and downloaded from the website of the formwork sponsor (www.doka.com) at any time.

6 Skill management and communication

6.1 Discussion Forum

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

6.2 Competitor information

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

This information includes:

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

6.3 Test Projects [and Marking Schemes]

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

6.4 Day-to-day management

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

6.5 General best practice procedures

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

Topic/task	Best practice procedure
Equipment failure	• If equipment or tools which are brought by the Competitor fail, no extra time is added to the Competitor.
Competitors' actions cause a threat to anybody's life and safety or damage organizers' equipment	• The Expert who notices any breaches to safety or damage to Competition Organizers' equipment must stop the execution of work, fix the breach, and inform the SMT of this fact. The SMT consult with the Competitions Committee Delegate on the next steps.
Interaction and communication with concrete pump operator	• At the Competition in course of pouring concrete the Competitors are allowed to interact and communicate with concrete pump operator. This is part of Test Project
Injury or health issues	• If the Competitor is injured or experiences any health issues, and insists on their further participation, this can only be permitted by the doctor.
Work execution by one participant	• If for some reason one of the Competitors cannot proceed with work execution at all or for a while, the other Competitor is allowed to execute the rest of work alone, provided that they observed the safety rules. If the former returns to the workshop, no extra time is added to the Competitor.

7 Skill-specific safety requirements

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

Task	Safety glasses with side protection	Dust mask	Cut protection gloves	Gloves rubber	Safety shoes with protective cap and sole insulation	Sturdy shoes with closed toe and heel	Tight fitting work clothes (long trousers)	Hearing protection	Helmet	Safety belt for construction at 2 meters higher
General PPE for safe areas						√				
Active areas	√				√		√	√	√	√
Circular saws	√	√			√		√	√	√	
Vibrator (concrete)	√			√	√		√	√	√	√

8 Materials and equipment

8.1 Infrastructure List

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

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

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

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

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

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

8.2 Competitors toolbox

Competitors may bring one toolbox with the total external volume not exceeding 2.4 m³.

(Volume = Length x Height x Width, or V = L x H x W)

Volume measurement does not include a packing crate, other protective packing material, palette for transportation, wheels, etc.

8.3 Materials, equipment, and tools supplied by Competitors

The following items are allowed to be carried in the toolbox:

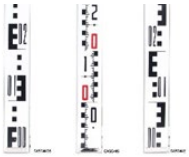
Description	Quantity	Photo
Alu lath	no limit	
Mortar pan or shovel with handle	2	

Description	Quantity	Photo
Square 90° different sizes	no limit	
Mitre box saw	1	
Finishing Trowel different sizes and types	2	
Carpenter´s hammer	no limit	
Hatchet	1	
Lump hammer	2	
Carpenter`s pliers	2	
Steel fixer's nippers - steel fixer's pincers	4	
Bolt cutter	2	

Description	Quantity	Photo
(Hand operated) bar-bender	1	
Binding Hook	no limit	
Ratchet with socket, set	1	
(Open jaw) spanner, set	1	
Ring spanner, set	1	
Screwdriver, set	1	
Chisel, set	1	
Toolbox	no limit	
Hacksaw	2	

Description	Quantity	Photo
Bow saw	1	
Hand saw	2	
Keyhole saw	2	
Scraper	no limit	
Concrete scraper	no limit	
Crowbar	1	
Claw bar	1	
Patter, float	no limit	
White-wash brush	no limit	

Description	Quantity	Photo
Round brush	no limit	
Trowels	4	
Shovels	2	
Wire brush	no limit	
Screw clamp	no limit	
Plane (non electric)	no limit	
Twist drill	no limit	
Mason drill and twist bit for wood	no limit	
Goggles - eye protection	4	

Description	Quantity	Photo
Safety shoes	2	
Ear protection (with decibel adjustments no radio)	4	
Level with staff	no limit	
Spirit level	no limit	
Plumb line	no limit	
Measuring tape	no limit	
Line	no limit	
Measuring rod	no limit	
Carpenter's square	2	

Description	Quantity	Photo
Angle empty	2	
Folding rule	no limit	
Measuring tools (non laser)	no limit	
Marking out string	2	
Pencil	no limit	
Tape	no limit	
Brush	no limit	
Bucket	2	

Description	Quantity	Photo
File, set	1	
Sandpaper	no limit	
Triangle Cutter	2	
Non-programmable scientific	1	
Extractor with silicone	no limit	

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

50% of all electric tools should be provided by the Competition Organizer so it can be ensured that every Competitor has the same fair conditions and no Competitor has an advantage. The other 50% of all electric tools are included in the Competitor toolbox.

The Workshop Manager is to be provided with a list of proposed electric tools of a high standard to be included in the Infrastructure List –per team. Such as below.

To be included in the Infrastructure List

- Electric jigsaw – 1 pc per team;
- Electric drill – 1 pc per team;
- Battery screwdriver with bits - 1 pc per team;
- Hammer drill – 1 pc per team ;
- Electric handsaw (with vacuum bags) – 1 pc per team;
- Electric cutter (steel bars) – 1 pc per team;
- Rotation laser – 1 per team;
- Table circular saw (with clean-air dust extractor)-1 per;
- Electric binder (with special binding wire) – 1 per team;
- High-frequency internal concrete vibrator- 1 per team;
- Concrete-mixer truck- 1.

8.4 Materials, equipment, and tools supplied by Experts

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

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

8.5 Materials and equipment prohibited in the skill area

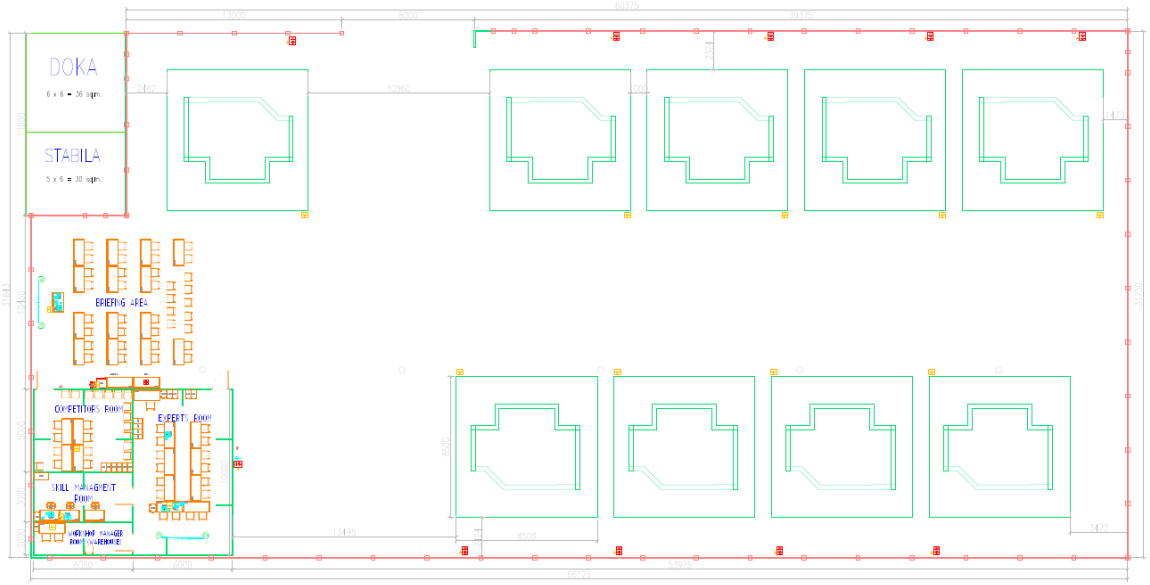
Competitors and Experts are prohibited to bring any materials or equipment not listed in section 8.3 and section 8.4.

Tools using compressed air and electric sanders are prohibited.

8.6 Proposed workshop and workstation layouts

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

Example workshop layout



9 Skill-specific rules

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

Topic/task	Skill-specific rule
Use of technology – USB, memory sticks	• Competitors, Experts, and Interpreters are not allowed to bring memory sticks into the workshop. If they do bring USB memory sticks, they must keep them in their locker. They are allowed to get them at lunch time and/or after the competition. The Skill Competition Manager, Chief and Deputy Chief Expert is exempt from this rule.
Use of technology – personal laptops, tablets, mobile phones, and other electronic devices	• Competitors are not allowed to bring personal laptops, tablets, or mobile phones into the workshop. If they do bring any of these, they must keep them in their locker. They are allowed to get them at lunch time and/or after the competition. • Experts, and Interpreters are allowed to bring personal laptops, tablets or mobile phones into the workshop only with the agreement of the SMT. • The Skill Competition Manager, Chief Expert, and Deputy Chief Expert is exempt from this rule.
Use of technology – personal photo and video taking devices	• Skill Competition Manager, Chief Expert, Deputy Chief Expert, Competitors, Experts and Interpreters are allowed to use personal photo and video taking devices in the workshop from C1 until C+1.
Templates, aids, etc.	• Competitors and Experts are not permitted to bring or use templates/patterns and prepared parts. Competitors are not allowed to make these during familiarization.
Drawings, recording information	• Competitors, Experts, and Interpreters are not permitted to bring drawings or prepared information into the workshop. This rule does not apply to the Chief Expert, Deputy Chief Expert, and Skill Competition Manager.

10 Visitor and media engagement

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

- Try-a-Skill;
- Display screens;
- Test Project descriptions;
- Enhanced understanding of Competitor activity;
- Competitor profiles;
- Career opportunities;
- Videos of huge realized projects (in **the host country/region**) using formwork construction;
- Presenting products for daily use which are produced by using formwork construction;
- Workshop area with master classes for visitors;
- Components of Test Project digitization: ARVR for visitors.

11 Sustainability

This skill competition will focus on the sustainable practices below:

- All materials used can be recycled or reused (formwork);
- The formwork is handed back to the sponsor;
- The system formwork supplied by the sponsor and tools can be as a gift for college. (Five full equipment workplaces are very good for secondary vocational education);
- Competitors and Experts should use tools to facilitate measurement. (Simplify the measurement process);
- Fix attention Experts and Competitors on the measurements accuracy;
- Economical use of resources (pay attention to Experts and Competitors over-use of resources);
- Separate storage materials (different materials do not mix, every time materials ready to use);
- Planning ergonomics workshops;
- Make sustainability show area for visitors;
- Print posters and advertisement about outlook sustainability. Pin them to the walls to promote sustainability;
- Action "Take away Test Project" for visitors to choose and take it away after Competition.

12 References for industry consultation

WorldSkills is committed to ensuring that the WorldSkills Standards Specifications 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/) ILO 7114
- ESCO: (https://ec.europa.eu/esco/portal/home)
- O*NET OnLine (www.**onet**online.org/)

This WSOS (Section 2) appears to most closely relate to *Cement Masons and Concrete Finishers*: https://www.onetonline.org/link/summary/47-2051.00

and *Concrete Placers, Concrete Finishers and Related Workers*: http://data.europa.eu/esco/isco/C7114.

These links also enable adjacent occupations to be explored.

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

Organization	Contact name, position
Doka Group (Europe)	Adolf Bosch, Head of Product Management, Central Europe
Doka GmbH (Latin America)	Volker Penk, Regional Product Manager Latin America
EAP, Doka Region East Asian Pacific	Denis Kraenert, Head of Engineering Group