



Robotic Construction Challenge 2026 Rules Manual

The 2nd Robotic Construction Challenge

Release Notes

Date	Version	Changes
Aug 10	V1.0	First release

1. Introduction

The 2nd Robotic Construction Challenge (RCC 2026) will be held in conjunction with IROS 2026 in Pittsburgh, United States. The competition uses the Three Sisters Bridges as the local prototype and abstracts bridge piers, deck spans, and accessories into a standardized tabletop robotic construction task.

The challenge evaluates autonomous perception, grasping, placement, assembly, structural stability, and text-instruction following through two tracks: non-interlocking block bridge construction and interlocking block bridge construction. Each team may register for one track only, and rankings are determined separately for the two tracks.



Figure 1. The Three Sisters Bridges in Pittsburgh.



Figure 2. Bridge-inspired construction model.

2. Competition Tracks and Tasks

2.1 Unified Three-Stage Task Structure

Both tracks follow the same three-stage structure. Component counts, dimensions, and tolerances will be published in the final component list.

Stage 1: Pier Construction (Basic Challenge I)

The robot picks components from the randomized component picking area and builds two stable, approximately symmetric pier or abutment supports in the designated construction area.

Stage 2: Bridge Deck Placement (Basic Challenge II)

The robot places or assembles deck components to form a stable bridge deck connecting the two supports. Under Option A, this stage starts from organizer-built reference piers.

Stage 3: Text-Instruction Accessory Installation (Advanced Challenge)

The robot receives an on-site text instruction, selects the correct accessory from target and distractor objects, and installs it in the instructed region while preserving the main bridge structure.

2.2 Track 1: Non-interlocking Block Bridge Construction

Track 1 uses organizer-provided, non-interlocking cuboid components with unified specifications. Components are made of engineering plastic; selected components may use a muted golden-yellow finish inspired by Pittsburgh bridges. Stability is achieved through contact geometry, support relations, and placement accuracy.

2.3 Track 2: Interlocking Block Bridge Construction

Track 2 uses a standardized LEGO-compatible interlocking system. The task structure is the same as Track 1, but a component is valid only when the required interlocking relation is correctly engaged and the component is seated within the published tolerance.

2.4 Text Instruction and Accessory Set

Instruction-related scoring appears only in Stage 3. The official instruction is text-only and displayed by the official system. Any oral reading is for convenience and does not override the displayed text.

- Recommended form: “Install the [type/color] accessory in the [left/center/right] region with the [orientation].”
- The candidate set includes one valid target and at least two distractors that differ in type, color, or required connection.
- The exact instruction and candidate arrangement are not disclosed before the official attempt.

3. Competition Environment

3.1 Workbench and Zones

Each team will be assigned an organizer-approved workbench. The workbench surface is 30 cm × 50 cm and does not include the robot. The robot base must remain outside the workbench and must not enter the workbench projection area.

The workbench is divided into three marked zones: a construction area, an accessory area, and a randomized component picking area. The official geometric reference is the printed or machined workbench template supplied by the organizer.

Figure 4. Competition Workbench Layout (Top View)

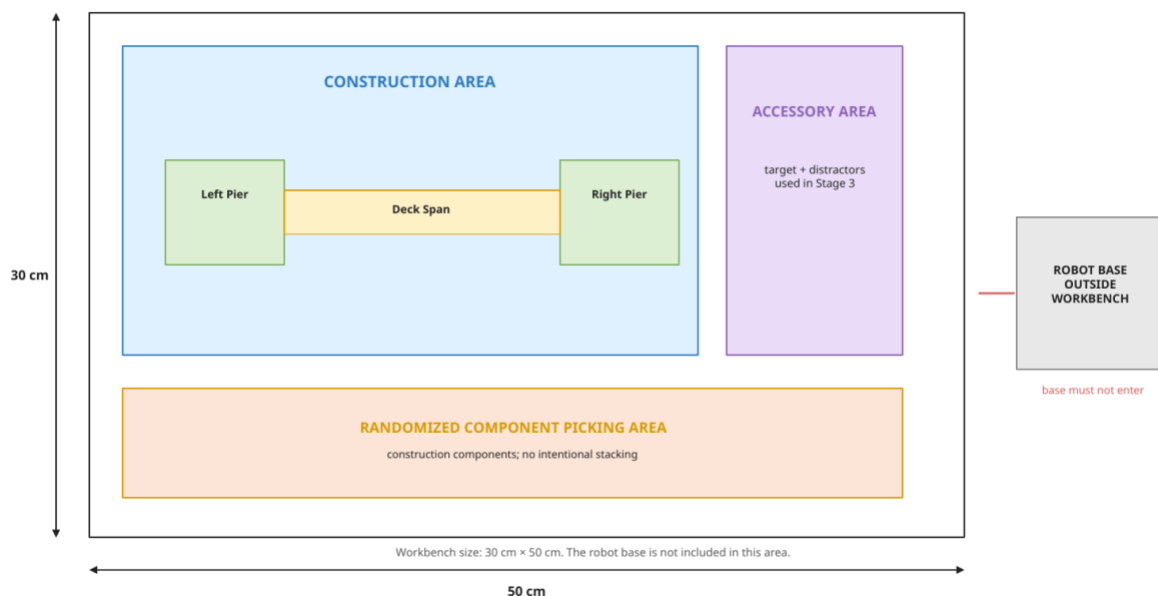


Figure 4. Top view of the competition workbench. Editable source is provided in the accompanying PPT file.

3.2 Environment Parameters

Item	Requirement
Workbench	Rigid, level, matte surface; 30 cm × 50 cm; organizer-controlled coordinate frame.
Construction area	Marked region for pier construction, bridge-deck placement, and accessory installation.
Accessory area	Contains the target accessory and distractors during Stage 3.
Randomized component picking area	Contains official construction components before each attempt; no intentional stacking.
Robot base	Must remain outside the workbench. Robot links and end effectors may enter the workbench after the start signal.
Safety boundary	No participant may enter the robot operating area during an official attempt.

3.3 Competition Components and Randomization

All scoring components are supplied and controlled by the organizer. Teams may not replace, modify, mark, coat, drill, magnetize, or attach material to official components.

- Track 1 uses non-interlocking engineering-plastic blocks with published dimensions and tolerances.
- Track 2 uses standard interlocking bricks from the official component list.
- Stage 3 uses accessory candidates consisting of one target and distractors from the published accessory taxonomy.
- Before each attempt, the organizer places the required components according to a competition-controlled randomization procedure. The same difficulty policy is applied to all teams in the same round.
- If an arrangement violates the published randomization constraints, the judge will re-randomize before the start signal.

3.4 Robotic Arms, Sensors, and Computing

Teams may use the robotic arms provided by the organizer or bring approved fixed robotic arms. Up to two robotic arms may be used simultaneously. The organizer-recommended robotic arm is the DISCOVER Robotics AIRBOT Play.

- Teams may use fixed sensors and arm-mounted sensors, including RGB cameras, RGB-D or depth cameras, force/torque sensors, tactile sensors, lighting, and local computing units within the published equipment envelope.
- Each robot base must be fixed during an official attempt. External sensors must be mounted before the start signal and may not be manually repositioned during the attempt.
- Internet or remote human control is prohibited during scoring. Local off-board computation is permitted subject to safety and interference requirements.

4. Competition Requirements

4.1 Autonomous Operation

- After the judge gives the start signal, all task-related perception, planning, grasping, placement, insertion, correction, and completion decisions must be executed autonomously by the robot system.
- Team members may not touch the robot, workbench, components, sensors, cables, or computing devices during an official attempt, except to activate an emergency stop when safety is at risk.
- Manual teleoperation, keyboard or mouse control, gesture commands, hidden human labeling, and manual stabilization of the structure are prohibited.

4.2 Allowed and Prohibited Methods

- Official components must be placed or assembled individually by a robot end effector. A dual-arm system may manipulate at most two components simultaneously.
- Robots may autonomously adjust, remove, or replace previously placed components during the remaining task time.
- Pre-positioned jigs, hidden adhesives, suction fixtures attached to the workbench, magnetic assistive parts, unapproved fasteners, or external stabilization methods are prohibited.

- Teams may not intentionally damage or permanently deform an official component.

4.3 Start and End Conditions

- At the start, the robot must be in the approved initial pose, all official components must be in the randomized arrangement, and all team members must be outside the operating boundary.
- The timer starts on the judge's start signal and ends when completion is declared, the time limit expires, the team requests termination, an emergency stop is triggered, or the head judge terminates the attempt.
- Final measurement begins only after the robot has released all scored components and the structure reaches its first stationary state.

4.4 Equipment Inspection

- Teams using their own robot must submit dimensions, mass, power, safety, emergency-stop, and mounting information by the organizer's published deadline.
- The organizer may inspect hardware, software interfaces, emergency stops, and start poses before the competition. Equipment that creates safety risks or unauthorized workspace contact may be rejected.

5. Competition Mechanism and Scoring

The competition uses Option A: Independent Stage Scoring. Track 1 and Track 2 use the same 100-point score structure. Track 2 additionally requires the prescribed interlocking connections to be fully engaged wherever interlocking criteria apply.

5.1 Option A Format

- Stage 1 starts from an empty construction area and randomized pier components.
- Stage 2 starts from organizer-built reference piers and randomized deck components.
- Stage 3 starts from an organizer-built reference bridge foundation and deck, with randomized accessory candidates and an official text instruction.
- Each team receives two official attempts per stage. The higher stage score counts. If scores are equal, the faster attempt counts.

5.2 Stage 1: Pier Construction (30 points)

Criterion	Points	Standard
Valid structural components	12	Proportional to the number of required pier components that are valid.
Pier-zone completion	6	Both piers occupy the designated target zones; partial credit may be awarded for structurally usable placements.
Geometric consistency	6	Required height, left-right symmetry, and alignment with the construction axis.
Static stability	3	Piers remain valid and stationary during observation.
Efficiency	3	Awarded when minimum completion is satisfied; proportional to remaining time.

5.3 Stage 2: Bridge Deck Placement (35 points)

Criterion	Points	Standard
Valid deck components	12	Proportional to the number of required deck components that are valid.
Effective span	8	Deck forms the prescribed connection between the two supports.
Alignment and level	6	Centerline, orientation, height, and overhang are within published tolerances.
Static stability	5	Reference piers and scored deck components remain valid during observation.
Efficiency	4	Awarded when the effective span is fully satisfied; proportional to remaining time.

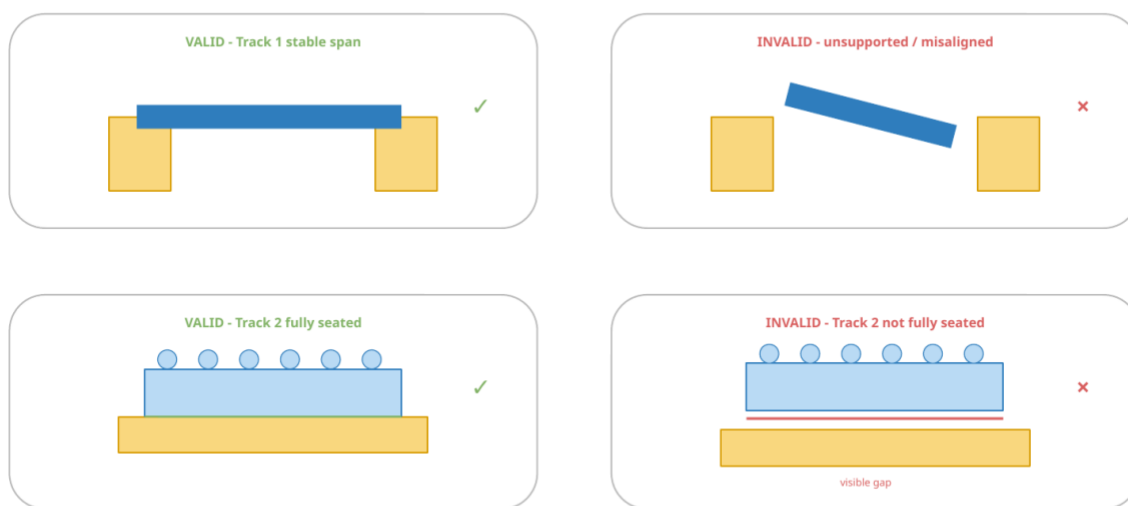
5.4 Stage 3: Text-Instruction Accessory Installation (35 points)

Criterion	Points	Standard
Instruction target match	6	Selected accessory type and required attributes match the official text instruction.
Target-object selection	6	Correct object is selected from the candidate set.
Installation region	6	Final accessory is in the instructed region.
Position accuracy	6	Final position is within the published translation tolerance.
Orientation / interlock quality	5	Orientation is correct; Track 2 requires prescribed connections to be engaged.
Preservation of main structure	3	Previously valid reference components are not displaced outside tolerance.
Efficiency	3	Awarded when the correct accessory is validly installed; proportional to remaining time.

5.5 Validity and Measurement Notes

A component is valid only when it is an official component, fully released by the robot, supported by the intended surface or connection, within the published position and orientation tolerances, and stationary during the observation period. For Track 2, the required interlock must be engaged.

Figure 6. Illustrative Validity Examples



Illustrative only. The published component list and tolerance table are authoritative.

Figure 6. Illustrative validity examples.

The organizer may use overhead cameras, side cameras, calibrated image processing, physical gauges, or direct measurement. The organizer-controlled workbench coordinate frame and judge measurement are authoritative.

5.6 Penalties and Ranking

Event	Penalty / Result
Participant intervention or teleoperation	Immediate termination of the attempt; scored criteria depending on final state may be invalidated.
Incorrect accessory remains installed at end	-5 points from Stage 3.
Official component deliberately placed outside the workbench	-1 point per component, up to -5 points per stage.
Damage to an official component caused by unsafe operation	Up to -10 points and possible attempt termination.
Unsafe motion or repeated boundary violation	Head judge may terminate the attempt.

Final ranking order: total score across the three stages; higher Stage 3 score; higher Stage 2 score; lower sum of counted attempt times; organizer-administered tie-break attempt; drawing lots if still tied.

5.7 Overall Time Limits

Stage time limits will be published before the practice stage. Current placeholders are:

Stage 1: [6] minutes;

Stage 2: [5] minutes;

Stage 3: [5] minutes.

The overall counted time for tie-breaking is the sum of the counted attempts for the three stages.

6. Competition Process and Challenge Schedule

The challenge consists of registration, practice, and the real-world final at IROS 2026. Exact dates and on-site times will be confirmed by the organizer.

6.1 Season Schedule

Stage	Participant Activities	Materials / Support Provided
Registration Stage Aug 11-Aug 25, 2026	Register through the official website; select one track; submit team and equipment information.	Official website, initial competition description, and rules release.
Practice Stage Aug 26-Sep 26, 2026	Practice in simulation and/or a real robotic-arm environment.	Workbench or drawings, building components, task examples, standardized simulator, robot model and interface.
Real-World Final Stage Sep 27-Sep 29, 2026	On-site check-in, setup, inspection, calibration, and real-robot competition.	Robotic arms, competition environment, judges, timing, measurement, and official components.

6.2 IROS On-Site Timetable

Time	Event
Day 1- Sep 27, 2026	Organizer move-in, workbench setup, system inspection, and judge training.
Day 2 - Sep 28, 2026	Track 1 participant check-in, equipment inspection, preparation, official attempts, score confirmation, and ranking.
Day 3 -Sep 29, 2026	Track 2 participant check-in, equipment inspection, preparation, official attempts, score confirmation, and awards ceremony.

6.3 Official Attempt Procedure

- The team leader confirms readiness. All team members leave the operating boundary.
- The judge issues the start signal and starts the official timer.
- The robot performs the task autonomously while judges record validity, faults, penalties, and timing.
- At completion, timeout, or termination, the robot stops and retreats. Judges observe the first stationary state and calculate the score.

7. Participation and Registration

- Every participant may join only one team in this competition.
- Each team must have at least one and no more than five registered members.
- Each team must register for one track only: Track 1 or Track 2.
- Each team must designate one team leader responsible for communication with the organizer, on-site decisions, score receipt, and appeals.
- Each team may designate one faculty supervisor with teaching or research qualifications at the team's institution.

- Teams bringing their own robots may be required to submit additional safety, logistics, and power information by email.

8. Awards

Awards are determined separately for the two tracks. Cash amounts are pre-tax and subject to final sponsor confirmation.

Prize	Ranking	Quantity	Awards
First Prize	First place	1 per track	Achievement certificates and cash reward Track 1: USD 1,500; Track 2: USD 2,000
First Prize	Second place	1 per track	Achievement certificates and cash reward Track 1: USD 800; Track 2: USD 1,000
First Prize	Third place	1 per track	Achievement certificates and cash reward Track 1: USD 500; Track 2: USD 600
Second Prize	Fourth to Eighth	5 per track	Achievement certificates for each registered team member.
Third Prize	Ninth to Sixteenth	8 per track	Achievement certificates for each registered team member.

9. Safety Considerations

Safety takes priority over score. Event staff and judges will be trained before the competition and will be available to assist participants. Emergency exits and first-aid locations will be identified by the venue.

- Every robot station must have an accessible, functioning emergency stop.
- Robots must operate within published speed, acceleration, payload, force, and workspace limits.
- Participants may enter the operating boundary only when power is disabled or the judge has placed the station in a safe state.
- Cables, computers, tools, and packaging must not obstruct emergency routes or adjacent stations.
- The head judge may stop any operation without prior warning when a safety risk is observed.

10. Appeals

10.1 Appeal Materials

- Save the appeal statement and supporting files in one folder with a total size not exceeding 100 MB and submit it to the arbitration staff through the official channel.
- Each video may not exceed one minute. Photos must be in JPG or PNG format. Text documents must be in PDF format and should not exceed 1,000 characters per disputed incident.
- Each text statement should correspond to one video or photo and identify the exact rule, time, and scoring item being disputed.

10.2 Appeal Decision

- The Arbitration Commission may maintain the original result, correct a score, invalidate a score, or order a rematch.
- Teams may not appeal against the decision made by the Arbitration Commission.
- If a rematch is required and the team refuses the rematch, the appeal is deemed failed and the original result is maintained.

11. Q&A

After the start of the practice stage, the committee will set up an official chat group in which it will conduct online Q&A sessions and upload frequently asked questions in the competition onto the group's "Q&A Files."