

WALL LINE TRACK ROBOT

Rescue Robot Competition Rules

Competition	Category	Team Members	Robot Construction
Wall Line Track	Junior / Senior	1–2 participants	Pre-Made

1. Description

Wall Line Track is an autonomous rescue-robot competition that simulates the delivery of relief supplies to victims trapped in a disaster area. Participants must design and build a robot capable of transporting four types of relief supplies, represented by cubes in four different colors, to their corresponding safe zones. The route includes various obstacles, some of which may be crossed and some of which are prohibited. Participants must program the robot to travel along a safe route, deliver as many relief-supply types as possible, and return to the designated mission endpoint.

2. Robot

2.1. Robot Type: A wheeled mobile robot capable of transporting cubes.

2.2. Robot Construction

2.2.1. The robot must be built and assembled at the competition venue.

2.2.1. Robot Dimensions

2.2.1.1. The robot must not exceed 20 cm × 20 cm.

2.2.1.2. Measurement Procedure:

- Participants may freely measure the robot during the building and practice period.
- The judges will measure the robot before the competition begins.
- The robot may be powered on during measurement. Any measurement performed after power-on must be conducted under the supervision of a judge. The judge's decision is final and cannot be contested.
- If the robot exceeds the permitted dimensions, the team will be given 1 minute to make corrections under the supervision of a judge. Failure to comply within the allotted time will result in disqualification from that round.
- If the robot's dimensions change after inspection and before it leaves the START area during the run, the team will be disqualified from that round for violating the dimension requirement.

2.2.2. Sensors: There is no restriction on the type or number of sensors installed on the robot.

2.2.3. Power Source

2.2.3.1. The robot must be powered solely by batteries and must not be connected to any external power source (off-grid operation). Combustion engines of any kind are prohibited.

2.2.3.2. The power supply must not exceed 12 volts, or 13.5 volts when fully charged. Alternatively, a maximum of eight AA batteries rated at 1.5 volts each may be used.

2.2.4. Robot Structure: There is no restriction on the materials used to construct the robot. Permitted materials may include plastic, wood, PVC foam board, metal, 3D-printed parts, perforated plastic sheets, and other suitable materials.

- 2.3. Programming and Control: The robot must move autonomously under program control. Programming must be performed offline only. External control during the competition is prohibited, except that the participant may hold the robot in its starting position before the run begins.
- 2.4. Motor and Wheel Assembly: Wheels or tires do not need to be separated from their assemblies.
- 2.5. The robot may be damaged during the competition. Participants are responsible for inspecting and protecting their own robot.

3. Playfield

- 3.1. The playfield is constructed from at least 36 Plaswood or PVC foam-board tiles, each measuring 30 cm × 30 cm. It consists of 10 different route patterns, four types of relief-supply delivery areas, and four colored Check Point tiles.



Fig. 1 10 playfield layout designs

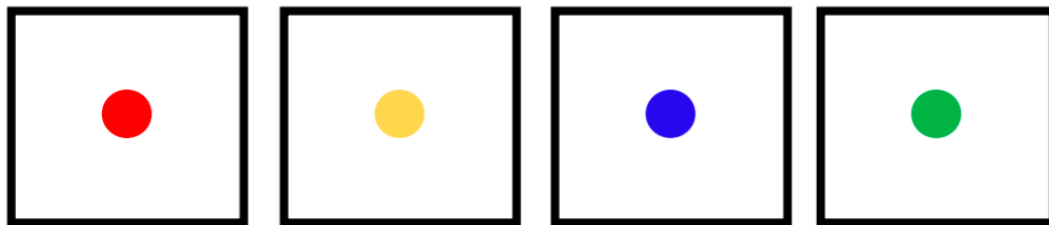


Fig. 2 Check Point



Fig. 3 Relief-supply delivery areas

3.1.1. Playfield Connection: The playfield is assembled by arranging and connecting the route tiles.

3.1.2. Field Tolerance: The field may have a maximum inclination of 2 degrees. Raised edges or gaps between tiles must not exceed 2 mm.

3.1.3. Fall Protection: No protective structure will be installed to prevent the robot from falling off the field.

3.2. Field Details

3.2.1. Route Tiles: Each route tile is made of Plaswood or PVC foam board and measures 30 cm × 30 cm. There are 10 route-pattern designs.

3.2.2. Check Points: Each Check Point tile measures 30 cm × 30 cm and is marked with one of four different colored stickers.

3.2.3. Relief-Supply Delivery Tiles: Each delivery tile measures 30 cm × 30 cm and is marked in one of four colors corresponding to the Check Points.

3.2.4. START and FINISH: The positions and travel directions of the START and FINISH points may vary according to the mission layout used in each competition.

3.3. Field Obstacles

3.3. The competition committee may add obstacles to the field at its discretion. These may include the following:

3.3.1. Black Pit: A 30 cm × 30 cm tile with a 20 cm × 30 cm black sticker placed at its center. The robot is prohibited from crossing the Black Pit tile.

3.3.2. Landmines: Red cubes measuring 2 cm × 2 cm × 2 cm and weighing 15–30 grams. They may be placed at 30 cm intervals along the route line.

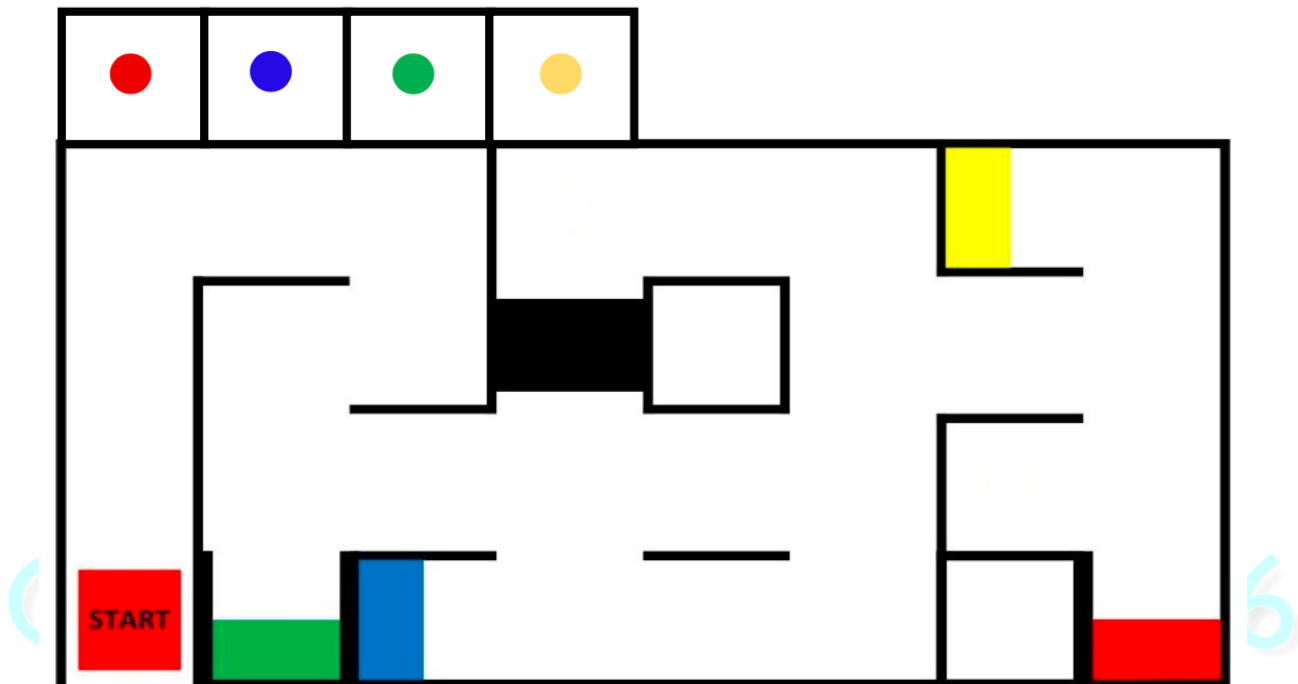


Fig. 4 Example Competition playfield

4. Competition Procedure

- 4.1. This is a record event. Rankings are determined by the score or recorded result achieved. The competition consists of two rounds, with a modification period between rounds. The final score is calculated from the mission score and time record.
- 4.2. Robot Building and Practice Time: At least 2 hours will be provided. The official duration will be announced on the competition day.
- 4.3. Mission: The robot must visit each colored Check Point to receive relief-supply cubes. Only cubes matching the color of the Check Point may be loaded, and they must be delivered only to the area of the same color. A maximum of two cubes of the same color may be loaded at one time at a Check Point. After completing the mission, the robot must return to the START point.
- 4.4. Playfield Assignments: Field assignments will be determined according to the number of participants and the competition difficulty level.
- 4.5. Robot Building and Practice: Participants may practice only on their assigned field until the announced practice period ends. Practice is prohibited before field assignments have been announced.
- 4.6. Round 1: The first round begins after the building and practice period ends. The lunch break may be adjusted according to the competition-day schedule.
 - 4.6.1. Pre-Round Preparation: When practice ends, all participants must submit their robots for inspection at the judges' table and wait for instructions from the judges and field staff at their assigned field.
 - 4.6.2. After the Round: Participants must remain in the waiting line until their own run and all other runs in that group are complete. They may retrieve their robots and return to their seats only after the entire round has finished.
- 4.7. Modification Time: After Round 1, the judges will change the field layout and randomly reassign all Check Points, relief-supply delivery areas, and obstacle positions. Teams will receive at least 30 minutes to modify their robots and programs.
- 4.8. Round 2: Round 2 begins immediately after the modification period. The judges will announce the new field configuration to all participants at the same time.
 - 4.8.1. Round 2 Pre-Round Preparation: The same procedure as Rule 4.6.1 applies.
 - 4.8.2. After Round 2: The same procedure as Rule 4.6.2 applies.

5. Match Progression

- 5.1. Mission Disclosure: The field layout, obstacles, START, FINISH, and Check Point positions will be announced simultaneously at the competition venue on the competition day.
- 5.2. The maximum competition time is 3 minutes.

5.2.1. Starting the Match

- 5.2.1. Participants must be ready at the field and will be given 30 seconds of setup time. If the robot's dimensions change from the inspected condition before it leaves the START area, the robot will be disqualified from that round.
 - 5.2.1.1. START Position: The robot must be placed completely within the START area and must travel out of it. If the robot shortcuts the route or moves in the opposite direction, it will be considered a False Start and must restart.
 - 5.2.1.2. Miss Start: If the robot does not begin moving within five counts (1–5) after the judge gives the start signal, it will be considered a Miss Start. The team may make up to three start attempts in total: the initial attempt plus two restarts.

5.2.1.3. The following are considered False Starts:

- The robot begins operating before the judge gives the start signal.
- The participant positions the robot so that it shortcuts the route from the START area.
- The robot moves in the opposite direction from the designated route.

5.2.1.4. Restart: A maximum of two restarts is permitted for a Miss Start, and one restart is permitted for a False Start. A False Start may be restarted only once.

5.3. Competition Rules

5.3.1. When setup time ends, the participant must place the robot at the START position and prepare for the run. No cubes are to be loaded at this stage.

5.3.2. When the judge gives the start signal, the participant must start the timer and press the robot's start button. The robot must travel to a Check Point, where the participant loads cubes matching that Check Point's color. A maximum of four cubes may be loaded per visit, and the robot must deliver them to the area of the same color. For example, after visiting the red Check Point, only red cubes may be loaded and they must be delivered to the red area to score.

5.3.3. A cube must be located entirely, 100%, within the designated delivery area to score.

5.3.4. Cubes may be loaded only at a Check Point. The robot must not be lifted from the field under any circumstances. If the participant touches or lifts the robot while loading cubes, the run will end immediately and no score will be recorded for that round. This is a disqualification for Robot Touch.

5.3.5. Missions may be completed in any order. The participant may choose any color first.

5.3.6. After completing its missions, the robot must return to the designated FINISH point. If it cannot return to FINISH, only the mission points already earned will be recorded. No FINISH score or mission-time bonus will be awarded.

5.3.7. The robot must complete at least one cube-delivery mission before returning to FINISH. If it returns without completing any delivery mission, no mission-time bonus will be awarded.

5.3.8. No Retry is permitted.

5.3.9. If the participant requests to stop the run, only the points already earned will be recorded. No mission-time bonus will be awarded.

5.4. End of Match

5.4.1. FINISH Point: The robot must stop correctly on the FINISH point. The participant must stop the timer manually, and the robot must remain in position for at least 3 seconds.

5.4.2. Arrival: If the robot reaches FINISH before the time limit and the participant stops the timer manually, the match ends and the mission score and recorded time at that moment will be used.

5.4.3. Time Over: If the robot cannot return to FINISH within the time limit, the score at exactly the end of the time limit will be the final recorded result. The result will be marked as unable to return to FINISH, and the recorded time will be 180 seconds.

5.4.4. Robot Stop: If the robot stops operating during the run, the judge will begin a 10-second countdown. If the robot does not resume operation, the judge will declare Robot Stop. Only missions completed up to that point will score. This result ranks below a team that continues until Time Over under Rule 5.4.3.

5.4.5. Landmine Collision: If the robot touches a landmine during the run, the match will stop immediately. Only points already earned will be recorded, and no time record will be awarded. This result ranks below results under Rules 5.4.3 and 5.4.4.

5.5. Disqualification

5.5. Any violation of the rules or interference with competition operations will cause the run to end immediately. All results from that round will be cancelled, with no opportunity for a replacement attempt, under the following conditions:

- 5.5.1. Robot Repair: During the competition, no robot part may be added, removed, replaced, or modified. If a team waiting for its run is found with spare parts, tools, or batteries intended for robot repair, the team will be immediately disqualified from the competition.
- 5.5.2. Sensor Adjustment: Adjusting or calibrating sensors on the competition field before the run will result in immediate disqualification.
- 5.5.3. Field Assignment Violation: Practicing or competing on a field other than the team's assigned field will result in disqualification.
- 5.5.4. Repeated Miss Start: A team that records three Miss Starts in the same round will be disqualified.
- 5.6. Rematch: In the event of an unexpected incident, such as a power outage, system failure, or equipment malfunction, the judges and organizers may order a rematch at their discretion.

5.7. Scoring

- 5.7.1. Entering a Check Point to receive cubes: 10 points per Check Point.
- 5.7.2. Correctly delivering relief supplies to a designated area: 10 points per delivery area.
- 5.7.3. Returning to the designated FINISH point:
 - 5.7.3.1. Complete mission, based on all Check Points visited: 20 points.
 - 5.7.3.2. Incomplete mission: 10 points. The mission-time bonus is then divided by two.
- 5.7.4. Mission-Time Bonus:

$$\text{Mission-Time Bonus} = (180 - \text{Time Used}) \times \text{Number of Missions Completed} \div 4$$

Examples:

- Team A completes all missions and reaches FINISH in 90 seconds: $(180 - 90) \times 4 \div 4 = 90$ bonus points.
- Team B completes 3 missions and reaches FINISH in 70 seconds: $(180 - 70) \times 3 \div 4 = 82.5$; because the mission is incomplete, $82.5 \div 2 = 41.25$ bonus points.
- 5.7.5. Wrong-color or wrong-location cube delivery: deduct 10 points.
- 5.7.6. Total Score:

$$\text{Total Score} = \text{Check Point Score} + \text{Delivery Score} + \text{FINISH Score} + \text{Mission-Time Bonus} - \text{Penalties}$$

6. Ranking and Judging

- 6.1. The scores from Round 1 and Round 2 will be added together. The team with the highest total score will be the winner.
- 6.1.1. Tie-Breaking: If two or more teams have the same final score, priority will be given to the team with the better single-round score, whether achieved in Round 1 or Round 2. If necessary, results will then be compared in the order specified in Rules 5.4.3, 5.4.4, and 5.4.5.
- 6.1.2. Referee's Decision: The referee has full authority to control all competition situations and participants from the beginning to the end of the event. All competition decisions are solely at the referee's discretion and are final.