

# RoboCup Junior (New Zealand) RESCUE / PREMIER RESCUE RULES 2017

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# Introduction

## Spirit

It is expected that all participants, students and mentors, will respect the aims and ideals of RoboCup Junior as set out in our mission statement. In turn, the volunteers, referees and officials will act within the spirit of the event to ensure the competition is competitive, fair and most importantly fun.

*“It is not whether you win or lose, but how much you learn that counts.”*

## Sharing

It is the overall desire of RoboCup Junior competitions, that any technological and curricular developments will be shared with other participants after the competition. Any developments including new technology and software examples may be published on the RoboCup Junior web site after the event, furthering the mission of RoboCup Junior as an educational initiative. Participants are strongly encouraged to ask questions of their fellow competitors to foster a culture of curiosity and exploration in the fields of science and technology.

# 1. The Challenge

## 1.1. The Challenge:

- 1.1.1. A terrible earthquake has hit the city and caused a large chemical storage unit to rupture spilling thousands of litres of toxic chemicals in the centre of the city. There is a person trapped on a sinking water tank in the middle of the chemical spill. Rescue crews are having trouble entering the city with the amount of rubble around and rescue from the air has also been ruled out due to the noxious gases rising around the city.
- 1.1.2. Junior and Senior Rescue: It has been decided that the best form of rescue is the deployment of an autonomous robot that can navigate to the scene and rescue the stranded person by pushing or dragging the water tank out of the chemical spill. **The water tank must be upright throughout the rescue.**
- 1.1.3. Premier Rescue: Remove the water tank from the chemical spill and place it in its original orientation safely on the evacuation platform for later collection by an aircrew.

## 1.2. The Events

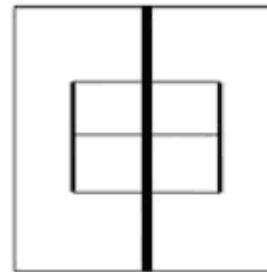
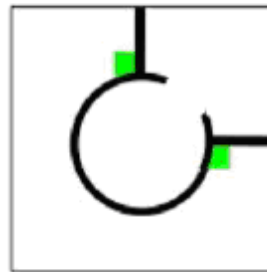
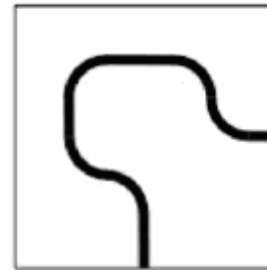
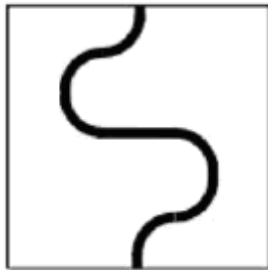
- 1.2.1. Primary school students (year 8 and below) will generally enter the Junior Rescue event. Experienced primary school students may enter the Premier or the Senior competition, but must choose just one of these three rescue events to enter.
- 1.2.2. Secondary school students (year 9 and above) where every team member is in their first year of Robocup competition, OR where the team has moved from using a commercial kit (e.g. lego) to building their own robot (e.g. arduino), may choose to enter the Senior Rescue event (no lift, no gridlock).
- 1.2.3. All other secondary school students must enter the Premier Rescue event.

### 1.3. The Field:

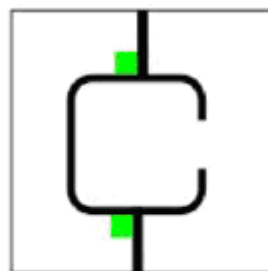
- 1.3.1. The field will consist of 594mm x 594mm tiles, with differing pattern. The final selection of tiles and their arrangement will not be revealed until the day of the competition.
- 1.3.2. There will be a minimum of 6 tiles in a competition field.
- 1.3.3. There are different tile designs (see examples below). Tile size has been selected so that each tile can be manufactured from an A1 sheet of paper (594x841)
- 1.3.4. The background colour of each tile is white with the line 15mm in width and black in colour.
- 1.3.5. All lines meet the edge of the tile halfway along its length.
- 1.3.6. Shortcut markers are green and 40mm x 40mm in dimension and indicate the correct path to follow.
- 1.3.7. The organising committee will make every possible attempt to ensure there are no 'bumps' between tiles although there may be slight deviations in height of up to 3mm. Competitors must be prepared to deal with these slight imperfections in height.
- 1.3.8. Junior Rescue: The tiles will be selected from Pool A only (see examples below). Competitors can expect tiles to be duplicated and/or omitted.
- 1.3.9. Senior Rescue: The tiles will be selected from Pool A and Pool B but will not include the Gridlock. Competitors can expect tiles to be duplicated and/or omitted.
- 1.3.10. Premier Rescue: The tiles and obstacles will be selected from both Pool A and Pool B. Competitors can expect tiles to be duplicated and/ or omitted.



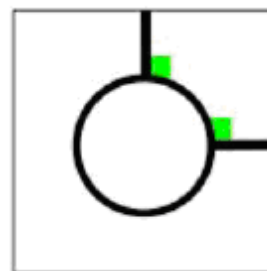
Start Tile



Bridge

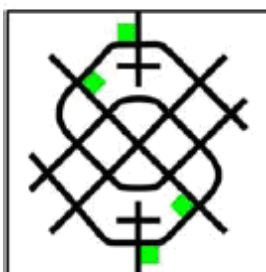


Dead End

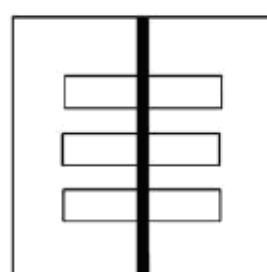


Roundabout

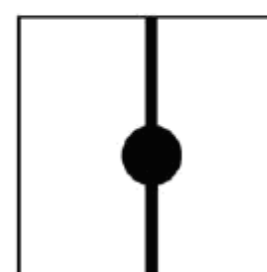
## Pool A



Gridlock



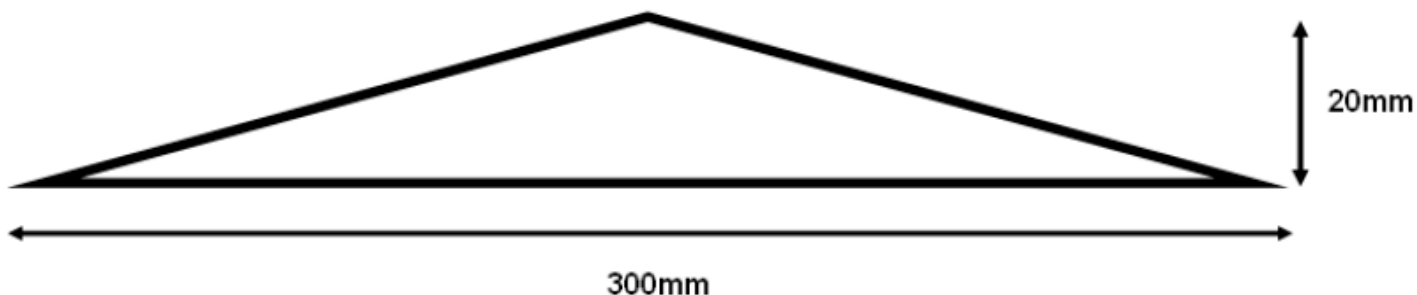
Speed Bumps



Water Tower

## Pool B

1.3.11 The “Bridge” tile will consist of a white raised section with the following dimensions with a black line across the middle of the bridge;



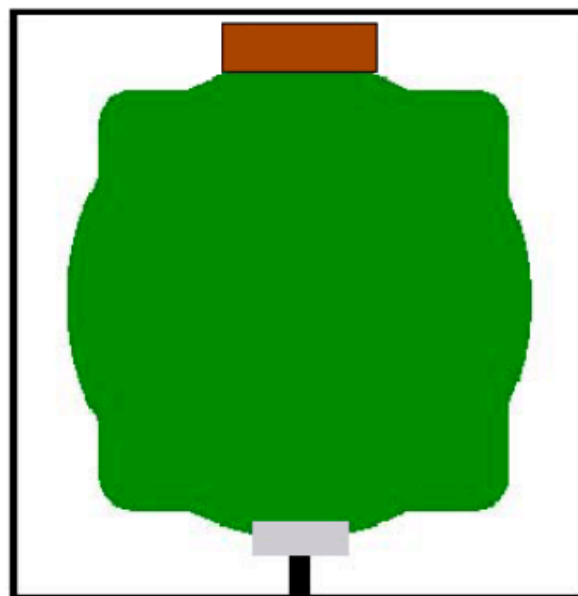
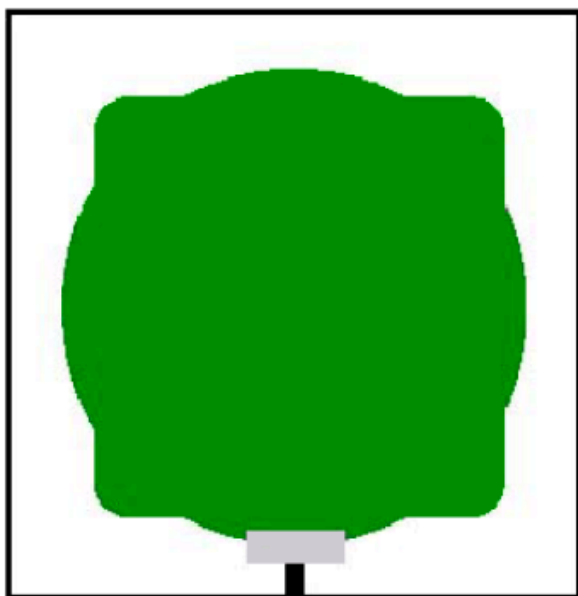
1.3.12. The “Speed Bumps” will consist of rectangular sections, 200mm x 30mm, white in colour, with a minimum height of 5mm. A black line will run across the top surface of the speed bump.

1.3.13. The “Water Tower” will be a clear 1.5 litre PET soft drink bottle filled with water. The tower is not to be intentionally moved from its location.

1.3.14 The final tile will be a 594mm x 594mm tile, white background with the chemical spill indicated in the green area.

1.3.15 At the point where the black line meets the green area, there will be a piece of reflective aluminium foil, 40mm x 15mm in dimension

1.3.16 Premier Rescue: The End Tile will also have the evacuation platform, 60mm high, 200mm wide and 60mm deep located at the rear of the chemical spill.



1.3.17 There shall be no substitution of any of the Tournament equipment (tiles, victim, obstacles, etc) competitors must come prepared to deal with the competition equipment provided by the organisers on the day.

## 1.4. Lighting

- 1.4.1 Teams must come prepared to calibrate their robots based on the lighting conditions available at the venue.
- 1.4.2 The organizing committee will make a reasonable effort to keep ambient light to a low level with infra-red (IR) sources from incandescent lights and natural lighting minimised.
- 1.4.3 Teams must also be prepared for other form of light interference from electronic devices and should take steps to protect their robot.

## 2. Robots

### 2.1. Diameter

- 2.1.1 The robot must fit within a 220mm diameter cylinder for the junior and senior rescue division. The robot must fit within a **300mm** diameter cylinder for the premier rescue division.
- 2.1.2. The robot must be upright in its normal running position.
- 2.1.3. The robot must be fully extended. (See section 3.2)

### 2.2. Height

- 2.2.1 The robot must be no more than 180mm in height for junior and senior rescue division and no more than **300mm** for premier rescue division. (see section 3.2) except for a compass sensor which may be placed at a height of up to 35 cm above the ground.

### 2.3. Control

- 2.3.1 Robots must be controlled autonomously.
- 2.3.2 Robots must be started manually by humans.
- 2.3.3 The use of remote control of any kind is forbidden.

### 2.4. Construction

- 2.4.1 Any robot kit or building materials may be used, as long as the robot fits the above specifications and as long as the design and construction are primarily and substantially the original work of the student(s) (see section 3.3)
- 2.4.2 Robots should be well engineered and constructed. The robot should not fall apart during the game.

## 3. Inspection

### 3.1. Schedule

- 3.1.1 The robot will be examined by a panel of referees before/during or after the

tournament to ensure that the robot meets the constraints described above.

- 3.1.2. It is the responsibility of teams to have their robot re-inspected if their robot is modified at any time during the tournament.

## 3.2. Robot Configuration

- 3.2.1. While being inspected, each robot must be at its maximum size; i.e., anything that protrudes from the robot must be fully extended. The robot must be standing upright in its playing configuration. If the robot has a moving part that extends in two directions, it will need to be inspected with this part operating. The robot must be able to operate without touching the measuring cylinder.

- 3.2.2. A robot entered into the **premier** rescue division **must have a demonstrable mechanism with the potential to rescue the victim** as specified in section 1.1.3.

## 3.3. Students

- 3.3.1. Team members will be interviewed and asked to explain the operation of their robots in order to verify that the construction and the programming of the robot is their own work. Logbooks or design diaries must be provided. (see section 7)
- 3.3.2. Students may be asked questions about their preparation efforts, and they may be requested to answer surveys and participate in videotaped interviews for research, promotional or archival purposes.
- 3.3.3. Commercial robot kits may be used but must be substantially modified by the students.
- 3.3.4. It is highly unlikely that a team will be able to legally use a robot identical to another team's robot from previous years, or use a robot that is identical to another team's robot.

## 3.4. Violations

- 3.4.1. Any violations of the inspection rules will prevent the robot from competing until modifications are effected.
- 3.4.2. Modifications must be made within the time schedule of the tournament. Game play will not be delayed due to late teams.
- 3.4.3. If a robot fails to meet all specifications (including modifications) the robot will be disqualified from that game (but not the tournament).
- 3.4.4. If there is excessive mentor assistance or the work on the robots is not substantially original work of the students, the team will be disqualified from the tournament.

## 4. Victim

### 4.1. The Victim

- 4.1.1. The victim will be represented by either a standard 355ml aluminium can, standing upright, with no markings OR a standard 355ml aluminium can wrapped in

aluminium foil or aluminium foil tape.

- 4.1.2. The can will contain material such as rice bringing the weight of the victim to 60gms. A liquid should not be used to add weight to the can.

## **5. Game Play**

### **5.1. Pre-game Set-up**

- 5.1.1. Organizers will make a reasonable effort to provide the teams access to the competition area at least an hour before the start of the competition.
- 5.1.2. Organizers will make a reasonable effort to allow at least 10 minutes of setup time before each round. Participants should be aware, however, that situations may arise where these conditions cannot be met; and so participants should arrive prepared to cope under conditions that are less than ideal.

### **5.2. Length of a Game**

- 5.2.1. A time limit of 120 seconds will be imposed. Organisers will ensure that the competition maze design will be of adequate length for this time limit.

### **5.3. Game Zone**

- 5.3.1. An area around the field will be designated as the "game zone". No one is allowed inside the game zone except for the robot handlers and the referee.

### **5.4. Start of the game**

- 5.4.1. One team member is elected as the robot handler. Only that team member is permitted to handle the robot during the game. All other team members must remain outside the game zone.
- 5.4.2. The robot is placed at the starting position and checked by the referee.
- 5.4.3. At the instruction of the referee, the robot's handler is to start the program on the robot.

### **5.5. Restarts**

- 5.5.1. A robot may re-start the run as the handlers deem necessary within the 120 seconds game time.
- 5.5.2. The robot must be positioned back at the start and checked by the referee
- 5.5.3. The game clock will continue to run during all restarts.
- 5.5.4. There is no limit to the number of restarts within the 120 seconds game.



5.5.5. The robot shall be awarded the points in its longest run during the game.

5.5.6. A robot must restart if:

- The robot ceases to follow the line,
- the robot is touched by a human,
- the robot moves off the field.

5.5.7. If a robot completes the course having missed some of the bonus points it may restart and try to collect those points. The clock keeps running and is only stopped when the bonus points are collected or until the clock reaches 120 seconds.

## **5.6. Following the Line**

5.6.1. The robot must follow the line completely to enter the chemical spill

5.6.2. Where there are multiple paths, the robot may take any path.

5.6.3. Where the line is discontinuous, the robot may search for the recommencement of the line, but must not completely leave the tile before re-finding the line.

5.6.4. For the purposes of determining if a robot has left the line or left the tile, the referee will use the “convex hull” of the robot. This measure is done by stretching an imaginary rubber band around the extremities of the robot, and using the enclosed space as a silhouette.

5.6.5. Some portion of the continuous line segment must be under the robots convex hull. Or, in the case of a discontinuous line, some part of the tile must be under the robot silhouette.

5.6.6. Once the robot has entered the chemical spill tile it is no longer required to “follow the line”. It may enter the chemical spill in any direction in its efforts to rescue the victim. However, if the robot leaves the spill area of the tile, it will have to restart.

5.6.7. A robot that travels directly across a break in the line will have to restart.

## **5.7. Rounds**

5.7.1. There may be any number of rounds, depending on the time constraints of the tournament.

5.7.2. Each team will play one game per round.

5.7.3. A round of games will commence, and end, based on a central time clock.

5.7.4. Teams, with their robot, must be present at some point during each round. Teams failing to show during the round will forfeit that round.

5.7.6. The victim will be located in a new position in the chemical spill for each round. It will be in the same position for every game in that round.

## 5.8. Scoring

- 5.8.1. Teams will be awarded 10 points for each tile that their robot successfully negotiates. E.g. robots reaching the 4th tile would have successfully negotiated 3 tiles and be awarded 30 points. A robot has not completed a tile until it has moved completely to the next one.
- 5.8.2. Teams will gain an extra 2 points for each shortcut marker they correctly follow. E.g. if a robot correctly follows both shortcut markers on the roundabout, it will be awarded 14 points, 10 points for completing the tile and 4 points for correctly following the shortcut markers. To follow a shortcut marker correctly the robot must turn towards the same side as the line as the marker is on.
- 5.8.3. For Junior and Senior Rescue, teams will be awarded an additional 20 points for successfully rescuing the victim. The victim is considered rescued when it is completely outside the chemical spill.
- 5.8.4. For Premier Rescue, teams will be awarded an additional 20 points for successfully gaining control of the victim e.g.: grasping or lifting the victim. Another 30 points will be awarded for successfully placing and releasing the victim on the evacuation platform, maintaining the victim's upright orientation.
- 5.8.5. If the robot fails to rescue the victim in the allocated time, it will be given a time score of 120 seconds.
- 5.8.3. For the premier rescue Gridlock tile, when the robot has successfully negotiated the 4 shortcuts and exited over the black line on to the next tile, as well as the 8 points for the 4 correctly followed shortcuts and 10 points for exiting the tile, an extra 22 points will be awarded, making 40 in all for a well-programmed Gridlock.
- 5.8.7. The team's worst points score is discarded and the overall point score is calculated as the sum of the remaining rounds.
- 5.8.8. Should two or more teams have the same points score, further ranking will be performed by finding the sum of the time taken to rescue the victim in the scoring rounds.

## 6. Conflict Resolution

### 6.1. Referee

- 6.1.1. During game play, the referee's decisions are final.

### 6.2. Special Circumstances

- 6.2.1. Specific modifications to the rules to allow for special circumstances, such as unforeseen problems and / or capabilities of a team's robots, may be agreed to at the time of the tournament, provided a majority of the contestants agree.

## **7. Documentation**

### **7.1. Log Books**

- 7.1.1. Any team that has original (custom) construction of robots or sensors (not freely or commercially available to all competitors) must supply full documentary proof that the developments were wholly the work of the students. This should be in the form of a logbook showing all stages of design, development, testing and construction.
- 7.1.2. All teams must maintain a logbook detailing the design, development and construction of the robot and its programs.
- 7.1.3. Failure to produce documentary proof may result in the robot or sensor not being allowed to be used in the tournament.

## **8. Code of Conduct**

### **8.1. Fair Play**

- 8.1.1. Robots that cause interference with other robots or damage to the field or the victim will be disqualified.
- 8.1.2. Humans that cause deliberate interference with robots or damage to the field or the victim will be disqualified.
- 8.1.3. No wireless or infra-red (IR) communication devices will be allowed during the game in the vicinity of the playing field.
- 8.1.4. It is expected that the aim of all teams is to play a fair and clean game of robot rescue.

### **8.2. Behaviour**

- 8.2.1. All movement and behaviour is to be of a subdued nature within the tournament venue.
- 8.2.2. Participants who misbehave may be asked to leave the building and risk being disqualified from the tournament.
- 8.2.3. These rules will be enforced at the discretion of the referees, officials, conference organizers and local law enforcement authorities.

### **8.3. Mentors**

- 8.3.1. Mentors, teachers and adults are not allowed in the student work area.
- 8.3.3. Mentors are not to repair robots or be involved in programming of student's robots.
- 8.3.4. Mentor interference with robots or referee decisions will result in a warning in the first instance. If this reoccurs, the team will risk being disqualified.

## Clarification of RoboCupJunior Rescue Rules

The following points are intended to clarify the rules for the rescue competition.

- 1 A robot gets 10 points for each tile it completes. It is not regarded as completing the tile until it is completely on the next tile.
- 2 A robot gets 2 bonus points for correctly following the green bonus markers.  
If the green marker is on the right side of the line, then the robot must turn right to get the bonus  
If the green marker is on the left side of the line, then the robot must turn left to get the bonus.
- 3 The student in charge of the robot may elect at any time to return the robot to the start of the course. Any points gained still stand. However, they can not be counted again if the robot restarts.
- 4 The robot must approach the green marker from the correct direction in order to be awarded the bonus point. It is possible to miss the bonus point for the first marker on a tile, but gain the bonus point on the second one.
- 5 If a robot completes the course having missed one or more of the bonus points, it can restart the course to try and collect the missing bonus points. Its time will then continue to run until the robot picks up all the remaining bonus points.
- 6 A robot that travels directly across a break in the line is deemed to be not following the line and must restart.
- 7 While searching for the victim on the final tile the robot must not leave the green spill area. If it does so it must restart. The robot is not deemed to have left the spill area until the entire robot has moved outside the green zone.
- 8 The competition is decided on the number of points scored. Times are only used if robots are tied on the number of points scored. Timing begins when the foremost part of the robot leaves the start tile.
- 9 If time permits, there will be 5 rounds in the competition. The course will be changed for each round. Points scored are calculated as a percentage of the total points available. However many rounds, each team discards the lowest of their scores.
- 10 The difference between senior and premier events, is that the **senior** event will **not** use the Gridlock tile, the robot is **not** required to have a lifting device, and will **not** be expected to lift.