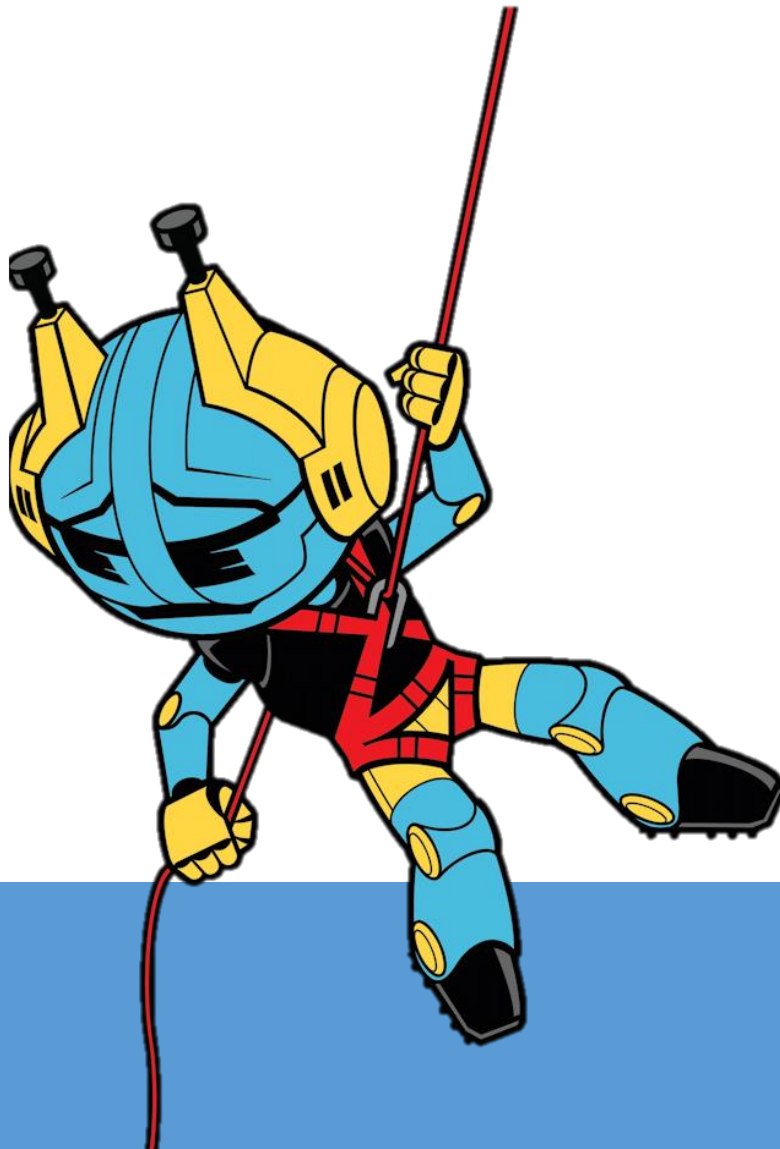




RoboCup Junior Victoria

Rescue Line Rules 2021

Last Modified: 20 February 2021



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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 event 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 events, that any technological and curricular developments will be shared with other participants after the events. Any developments including new technology and software examples may be published on the RoboCup Junior website 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.

These Rules Apply in Victoria Only

These rules are derived from (with simplification and occasional modification) the RCJA Rescue Line Rules. This is not a separate Challenge and the modifications are designed to allow greater accessibility to the Challenge in Victoria, whilst still preparing students to participate at the RCJA Australian Open.

These rules only apply for the Victorian Regional and State Rescue events. They do not apply in other states, or at the RCJA Australian Open. Whilst some notes have been included regarding rule differences, these are not exhaustive and notes regarding the significant differences in the scope of the Rescue Field have not been included.

Notes/Advice vs. Rules

This document includes notes/advice to the competitors and mentors, plus rules that are firm. This has been done to remove ambiguity. There is a notation to indicate whether the content of this document is to be read as a note/advice or as a rule. **Notes/advice appear in green.**

Changes

Where material, and/or hard to spot, additions are in **red**, deletions are ~~struck out~~.

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1 The Challenge

1.1 The Scenario

1.1.1 A terrible disaster 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 in a sinking rescue capsule (the Victim) in 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 from the toxic chemicals directly above the spill. It has been decided that the best form of rescue is the deployment of an autonomous robot that can navigate to the scene, rescue the Victim and exit the Chemical Spill.

Your team has been asked to design, make and appraise a robot to complete this challenge.

- 1.1.2 Riley Rover Rescue: The robot must navigate to the scene, find and then rescue the Victim by pushing or dragging the Victim out of the Chemical Spill.
- 1.1.2 Primary Rescue: The robot must navigate to the scene, find and then rescue the Victim by pushing or dragging the Victim out of the Chemical Spill. The robot must then save itself by exiting the Chemical Spill.
- 1.1.3 Secondary Rescue: The robot must navigate to the Chemical Spill and then rescue the Victim by first controlling the Victim and then manoeuvring and leaving it outside of the Chemical Spill in its original orientation. The robot must then save itself by exiting the Chemical Spill.
- 1.1.4 Open Rescue: The robot must navigate to the Chemical Spill and remove the Victim from the Chemical Spill and place it in its original orientation safely on the Evacuation Platform for later collection by an aircrew. The robot must then save itself by exiting the Chemical Spill.
- 1.1.5 Teams will participate in a number of Preliminary Rounds which culminate in a final Head to Head Round where the top three teams will be awarded first, second and third place as a result of them demonstrating the best solutions to the challenges according to the rules.
- 1.1.6 At the discretion of the Chief Judge, more or fewer teams may be taken to the final Head to Head Round.

1.2 Participants

1.2.1 Students must be of primary or secondary school age.

1.2.2 Students may participate in one of four divisions: Riley Rover Rescue, Primary Rescue, Secondary Rescue or Open Rescue as per the table below. Divisions are listed in order of difficulty (least to most). Teams can also compete in Rescue Maze.

Division	Age Category	Maximum Years a Student May Participate
Riley Rover Rescue	Primary or Secondary school students	One year (see 1.2.4)
Primary Rescue	Primary school students	No limit See 1.2.3
Secondary Rescue	Primary or Secondary school students	See 1.2.3
Open Rescue	Primary or Secondary school students	No limit

1.2.3 Students may participate in Primary and Secondary Rescue an unlimited number of times, however they may only use the same hardware/software combination twice. The use of NXT/EV3 and the Lego programming environment is considered the same for the purposes of the entry in Secondary Rescue.

Some examples of hardware/software combinations that would entitle a student to participate in Secondary Rescue more than twice include:

- **Year 1 & 2:** Lego NXT & NXT-G or Lego EV3 & EV3-G
- **Year 3:** Lego NXT & NXC or Lego EV3 & EV3Basic for EV3 or EV3Dev
- **Year 4:** Lego motors & sensors & Arduino/Raspberry Pi processor
- **Year 5:** Arduino/Raspberry Pi processor & 3D printed components

Mentors: Before encouraging a student to enter under this rule, confirm the eligibility of the technology combination with the Rescue Coordinators.

1.2.4 Riley Rover Rescue is a beginner's division. Mentors are asked to direct their students to participate in a more complex division should they be ready and capable of doing so. On the event day, students who show a skill level higher than expected of beginners may be directed to participate in a more complex division. Alternatively, they may opt to participate in Riley Rover Rescue and be ineligible for prizes. Additionally, students may not participate Riley Rover Rescue if they have previously participated in any other division(s).

1.2.5 Teams are required to ensure each participant's full name is correctly recorded in the registration system. Teams will have their members verified to ensure compliance with the past participation rules. Violations will result in all teams from the offending organisation being ineligible for prizes at the event. Students may be asked to display Photo ID to assist with verification.

1.3 Teams

1.3.1 A team consists of ~~from one, to~~ two, three, four, or five student(s). A team does not include mentors (teachers, parents, older students or otherwise).

If you intend to participate in the RoboCup Junior Australia Australian Open, please check the requirements regarding minimum team size, as they differ.

2 Playing Field

All measurements in the rules have a tolerance of 5%.

2.1 Field

2.1.1 The RCJV Rescue Field Specifications may be found here: <https://robocupjunior.org.au/vic/rescue>.

2.1.2 Tiles will be selected for each division as below:

	Base Pool	Physical Pool 1	Physical Pool 2	Logical Pool 1	Logical Pool 2
Riley Rover Rescue	✓	✓			
Primary Rescue	✓	✓	✓	✓	
Secondary Rescue	✓	✓	✓	✓	
Open Rescue	✓	✓	✓	✓	✓

2.1.3 Each field will consist of a City Limits tile, Chemical Spill tile, and a minimum of three other tiles.

2.1.4 The field layouts will vary between rounds.

2.1.5 The city limits tile is a lead in tile and does not count for any points. Robots must start fully behind the join between the city limits and following tile.

2.1.6 Robots must be able to navigate through the doorway. The doorway will be centred over the line. It will be free standing and hence may easily fall over if knocked. If the doorway falls, the robot must restart. If a robot cannot pass through the Doorway, it will receive a score of zero and maximum time.

2.1.7 If the robot does not pass through the doorway due to the robot not navigating the tile for any reason, the robot must still be able to pass through the doorway or the robot will receive zero points and maximum time for this round.

2.2 Lighting

2.2.1 Teams must be prepared to calibrate their robots based on the lighting conditions available at the venue.

Teams should test their robot under a variety of even and uneven light conditions and under light from a variety of sources.

2.2.2 The Rescue Coordinators will attempt to ensure that lighting is even and consistent and that infrared (IR) sources are kept to a minimum, but this cannot be guaranteed.

2.2.3 There may be other forms of interference present, both visible and non-visible. Concerned teams are advised to shield their sensors appropriately.

3 Robot

3.1 Control

- 3.1.1 Robots must operate autonomously. Remote control of any kind is forbidden. If the robot has the capability for remote or other forms of wireless control either by Bluetooth, Wi-Fi or some other form of wireless communication, the team must prove that they have disabled the capability for third party operation in some way. This could be by software, hardware or degree of human interaction. Robots that do not comply may face immediate disqualification from the tournament. Distributed control is allowed but must operate without human interaction after the robot has started the round.
- 3.1.2 Robots must be started/restarted manually by the robot handler.
- 3.1.3 Pre-mapping and types of dead reckoning (i.e. configuring the robot's program based on predefined locations, tiles, obstacles, location of Victim, number of Victims etc. before game play) are prohibited.

3.2 Construction and Programming

- 3.2.1 Any robot kit, building materials and programming language may be used, providing that the robot fits within the specifications documented in these rules and the design, construction and programming are substantially the original work of the team members.
- 3.2.2 Robots should be well engineered and constructed and should not fall apart during a Game. Should parts fall off the robot they will not be removed from the field during the round. Should a robot substantially fall apart, it will be deemed damaged by the referee and removed from the field. Damaged robots may be repaired and restarted during a game, however the game clock will not be paused or reset.
- 3.2.3 Commercial robot kits may be used ~~however must be~~ **but only when they have been** substantially modified **by the team member(s). Commercial robot kits where the construction is primarily fixed or cannot be substantially customised (including the chassis) are not permissible.**
- 3.2.4 Teams may not modify their robots once the game clock has started, however robots may be repaired.

If you intend to participate in the RoboCup Junior Australia Australian Open, please note robot repair rules (once the game clock has started) differ.

- 3.2.5 Riley Rover Rescue: robots must be constructed using commercially available kits and programmed using a graphical programming language.

3.3 Violations

- 3.3.1 Any violations of the rules will prevent the robot from competing in a round until modifications are made and the robot conforms to the rules.
- 3.3.2 The event will not be delayed for the purpose of accommodating teams who need to make modifications.
- 3.3.3 Robots that cannot conform to the rules in time for a round will be disqualified from that round (but not the event).
- 3.3.4 If it is determined that the work on the robot is not substantially the original work of the team members or the construction or programming of the robot be deemed not that of the team, the team will be referred to the Rescue Coordinators. Should the Rescue Coordinator(s) or other relevant person on the advice of the Officials/Judges then uphold the view of the scrutiniser, the team may be disqualified from the event.

4 Game Play

Games will be organised into Preliminary, then Head-to-Head Rounds.

4.1 Pre-Competition Calibration and Practice

- 4.1.1 Prior to the beginning of the first round, teams will have access to the competition field(s) to gather sensor measurements and test their robots. Each competition field may be different. The Rescue Coordinator(s) or other relevant person will publicise the times of this period and will ensure there is variety of tiles for teams to prepare on. Teams will have no further access to competition courses during the event except to complete their scored rounds.
- 4.1.2 There may be a practice field available at the event. Robots may behave differently on this field. The practice fields may only be available periodically throughout the event.

4.2 Game Zone

- 4.2.1 An area around the competition fields will be designated as the game zone. Only officials, referees and robot handlers may enter the game zone. Other team members may communicate to the robot handler from outside the game zone.

4.3 Game Length

- 4.3.1 Each division has a game length and calibration window as below:

Division	Game Length (Maximum Time)	Calibration Window
Riley Rover Rescue	120 Seconds	Prior to the Game Clock starting
Primary Rescue	120 Seconds	Prior to the Game Clock starting
Secondary Rescue	150 Seconds	Prior to the Game Clock starting
Open Rescue	240 Seconds	After starting the Game Clock

- 4.3.2 Calibration prior to the game clock starting should take less than 30 seconds. Should recalibration be required once the game clock starts, the game clock will not be paused or reset.

- 4.3.3 Time limits may be extended for the Preliminary and/or Head-to-head round(s). This is at the discretion of the Rescue Coordinator(s). Participants will be informed of the change prior to the running of the round.

4.4 Pre-Game

- 4.4.1 One team member shall be elected as the robot handler.
- 4.4.2 The robot handler is the only team member who may communicate with the referee during the game.
- 4.4.3 The referee will ask the robot handler if they are ready to commence. The robot handler will ~~confirm~~ **check to ensure that** they are happy with the tile alignment and see-saw position. After **the referee receives** positive acknowledgement **from** the Robot Handler, **the Robot Handler** may place the robot on the course ready to start.
- 4.4.4 **Should the robot require calibration, the Robot Handler will advise the referee prior to commencement of the Game Clock that they wish to calibrate their robot. This only applies if calibration may occur prior to the Game Clock starting (see 4.3.1).**

4.5 Playing the Game

- 4.5.1 The referee will count down to the start and say 'Go' or similar. The game clock will commence and the robot or calibration, if applicable (Advanced Rescue only), may begin.
- 4.5.2 Robots must always work towards the Chemical Spill from the starting point. Robots may never work backwards, except when exiting the Chemical Spill (see 4.9.7).

4.6 Restarts

- 4.6.1 The robot handler may restart the robot due to malfunction, from any location, subject to the following penalties:

Riley Rover Rescue: Maximum time

Primary, Secondary and Open Rescue: Maximum time and a penalty of five points for each touch up to a maximum of twenty points

- 4.6.2 Robots that have completed a Rescue but have not gained all points available, may restart from any location (at least two tiles back from the Chemical Spill), to attempt to gain missed points.
- 4.6.3 The game clock will continue running during all restarts.
- 4.6.4 Tiles that are completed multiple times due to restarts will not result in additional points being awarded.
- 4.6.5 The Victim will not be moved or reset to the initial position during restarts, however, should the Victim fall over, the referee may return it to an upright position approximately centred where it fell.

4.7 Following the Line

- 4.7.1 Where there are multiple paths, the robot may take any path.
- 4.7.2 Where the path is discontinuous, the robot may search for recommencement of the line, but must not leave the tile before finding the line. In the event the robot leaves the tile before finding the line, it will be deemed that the robot has left the line.
- 4.7.3 If a tile has a continuous line, then some part of this continuous line must always be under the robot, else it will be determined that the robot has left the line.
- 4.7.4 If a tile has a discontinuous line, then some part of the robot must always be over the tile, else it will be determined that the robot has left the line.
- 4.7.5 For the purpose of determining if a robot has left the line the Referee will use the convex hull of the robot. This is done by stretching an imaginary rubber band around the extremities of the robot and assuming the enclosed space is part of the robot.
- 4.7.6 If it is determined that a robot has left the line, a Restart will be required (see 4.6.1).
- 4.7.7 Once the robot enters the Chemical Spill it is no longer required to follow the line. It may enter the Chemical Spill in any direction. Should the convex hull of the robot leave the Chemical Spill prior to rescuing the Victim the robot will have to restart.

4.8 Definition of Rescue

- 4.8.1 **Riley Rover Rescue and Primary Rescue:** The Victim is considered rescued when the Victim, as viewed directly from above, is not over the Chemical Spill in any way.
- 4.8.2 **Secondary Rescue:** The Victim is considered rescued when the Victim, as viewed directly from above, is not over the Chemical Spill in any way. Control of the tank means that if the robot is to move in any direction (including backwards) the Victim would move with it.
- 4.8.3 **Open Rescue:** The Victim is considered rescued when the Victim is released in an upright position on the evacuation platform. The Victim is considered released when the robot is in a position that should it move left, right, or backwards the Victim would not fall off the Evacuation Platform.

4.9 Scoring

- 4.9.1 Teams will be awarded 10 points for each tile the robot successfully navigates (as described in 4.7) excluding tiles specified in 4.9.3.
- 4.9.2 Teams will gain an extra 4 points for each intersection marker they correctly follow.
- 4.9.3 Teams will receive points as per the below table for each of the specified tiles.

Tiles	Points
See-Saw	15
Bridge	15
Speed Bumps	15
Water Tower	20

- 4.9.4 **Primary Rescue:** Teams will be awarded an additional 50 points when the Victim is successfully rescued.
- 4.9.5 **Secondary Rescue:** Teams will be awarded an additional 70 points for gaining control of the Victim, and 30 points for rescuing the Victim. Points for control of the Victim and rescue of the Victim are awarded independently. For example, a robot that rescues the Victim but does not control the Victim will be awarded 30 points. If the robot loses control of the Victim as soon as it begins to move it is not eligible to receive control points but may receive rescue points.
- 4.9.6 **Open Rescue:** Teams will be awarded an additional 50 points for successfully gaining control of the Victim (e.g. lifting the Victim to a height where it could be placed on the evacuation platform and maintaining this height when the robot moves). If the robot loses control of the Victim as soon as it begins to move it is not eligible to receive the relevant points. Another 50 points will be awarded for placing the Victim on the evacuation platform maintaining its original upright orientation.
- 4.9.7 **Primary, Secondary and Open Rescue:** Teams will be awarded 20 additional points for exiting the Chemical Spill. An exit is deemed successful when the robot has reached the tile immediately prior to the Chemical Spill (i.e., reach the second last tile prior to the Chemical Spill).
- 4.9.8 The time showing on the game clock is only awarded once all available points have been gained. If the robot was touched for a restart, maximum time shall be awarded.
- 4.9.9 The minimum score that any team can receive for a round is zero.

4.10 Preliminary Rounds

- 4.10.1 A briefing will be held prior to the start of the preliminary rounds to advise how the event will run. Team members are required to attend this briefing to be eligible to participate.
- 4.10.2 There will be three to five preliminary rounds.
- 4.10.3 Each team may attempt each round once.
- 4.10.4 The Victim may be in a different position for each round. The Victim will be reset to the same position or to an equivalent position (i.e., the mirror image position) for each team on a given round.
- 4.10.5 Teams must report for each preliminary round five minutes before their designated round time. Failure to do so may result in a score of zero points and maximum time.
- 4.10.6 After preliminary rounds have been completed, teams will be ranked according to their cumulative score. This will be calculated by the addition of the score of each round (after penalties). In the event of a tie, teams will be further ranked by their cumulative time of rounds.

4.11 Head to Head Round

- 4.11.1 The top three teams from the preliminary rounds for each division will then proceed to the Head to Head final. If there are three teams or less in the division, all teams in the division will take part in the trophy final.
- 4.11.2 The final will consist of one or more courses that each competing team will rotate through.
- 4.11.3 After finals rounds have been completed, the three teams will be ranked (in descending order) according to their cumulative score from the finals rounds. This will be calculated by the addition of the score of each finals round (after penalties). In the event of a tie, teams will be further ranked by their cumulative time (in ascending order), then by their cumulative touches (in ascending order).

5 Conflict Resolution

5.1 Referring and Officials

- 5.1.1 The referee's instructions and decisions must be adhered to. If you feel that a rule has not been correctly enforced, the robot handler (and optionally other team members) must raise the matter with the Rescue Coordinator(s) or other relevant person immediately. Mentors of less experienced teams may be present during this discussion for the purposes of moral support only.
- 5.1.2 Rule clarification and handling of disputes will be dealt with by the Rescue Coordinator(s) or other relevant person. Any decisions made are final.
- 5.1.3 At the conclusion of the event (once presentations have begun), the outcome of the event is final.
- 5.1.4 If a mentor feels a dispute has not been adequately addressed, they may escalate the matter to the RoboCup Junior Victoria State Chair in writing within seven days of the event.

6 Conduct of Students, Non-Competing Attendees and Mentors

- 6.1.1 Behaviour of students shall be as expected in a well-run classroom.
- 6.1.2 Mentor behaviour shall align with the RoboCup Junior Mission Statement.
- 6.1.3 Mentors warrant that each entry is the work substantially of the students.

- 6.1.4 At the RoboCup Junior Australia Australian Open, it is strictly enforced that Mentors and Non-Competing Attendees are not permitted in the student work. As the Victorian RoboCup Junior season progresses, the complexity of the Rescue Courses will increase. Mentors are asked to support the development of their students' independence.
- 6.1.5 Some students are developing their ability to problem solve and function under pressure. If a mentor feels they must assist their student in order for their student to have a good RoboCup Junior experience, they may do so but the student will be disqualified from placing in the top five.
- 6.1.6 If mentor assistance is provided to a student at an event, the mentor must notify the Rescue Coordinator(s) or other relevant person.
- 6.1.7 A team may be disqualified at the discretion of the Rescue Coordinator(s) or other relevant person when excessive assistance has been provided to them by a Mentor and/or any Non-competing Attendee(s) and/or more other students during the event.
- 6.1.8 At each event, Mentors and Non-Competing Attendees may be prohibited from entering the student work area but will be able to supervise their students from behind a nominal line.

7 Journals, Interviews, Sharing and Prizes

7.1 Journals

- 7.1.1 Journals are not required; however, teams may elect to use a journal as an aide for their interview.
- 7.1.2 Teams are advised that Journals are required to enter Rescue Line at the RoboCup Junior Australia Australian Open, and as such they should prepare them throughout the year if they intend on entering this event. Please see the RoboCup Junior Australia Rescue Line Rules for further details.

7.2 Interviews

- 7.2.1 Teams may be required to attend an interview on the event day. This will be used to check that the design, construction and programming of the robots are that of the students. An interview schedule for all teams may be published, or a team may be required to attend an interview at the discretion of the Rescue Coordinator(s) or other relevant person.
- 7.2.2 Teams must bring a running laptop or tablet to their interview with their program open and be able to talk through the logic of the program with the interviewer. Screenshots of the program are not acceptable.
- 7.2.3 See the document RCJV Rescue Interview Guide at <https://robocupjunior.org.au/vic/rescue>.
- 7.2.4 Should the interviewer believe that the construction and programming of the robot is not that of the team, the team will be referred to the Rescue Coordinator(s) or other relevant person. Should the Rescue Coordinator(s) or other relevant person uphold the view of the interviewer, the team will be disqualified from the event.
- 7.2.5 Interviews are not scored and subsequently do not affect a team's ranking. Interviews may be videotaped and published for educational purposes.

7.3 Interviews

- 7.3.1 Any technological and curricular developments may be shared with other participants after the event. Details of competitors' hardware, software and ideas may be published after an event, hence furthering the mission of RoboCup Junior as an educational initiative.

- 7.3.2 Participants are encouraged to ask questions of each other to foster a culture of curiosity and exploration in the fields of science and technology.
- 7.3.3 Teams may be required to upload their robot design and program source code a week prior to the event. Programs are not expected to reflect the final week of robot preparations completed by teams. Robot design and program source may be published for future students to use as a learning resource.
- 7.3.4 Student work may be published and shared under a Creative Commons license.

7.4 Prizes

- 7.4.1 Prizes vary from event to event and are awarded solely at the discretion of the event organisers. Prizes can be awarded for reasons including (but not limited to) team placement, effort, engineering, engagement.