RoboCup Rescue 2022
Draft Rulebook
Part 2: Maneuvering

Version 2022-04-14.

Maneuvering:

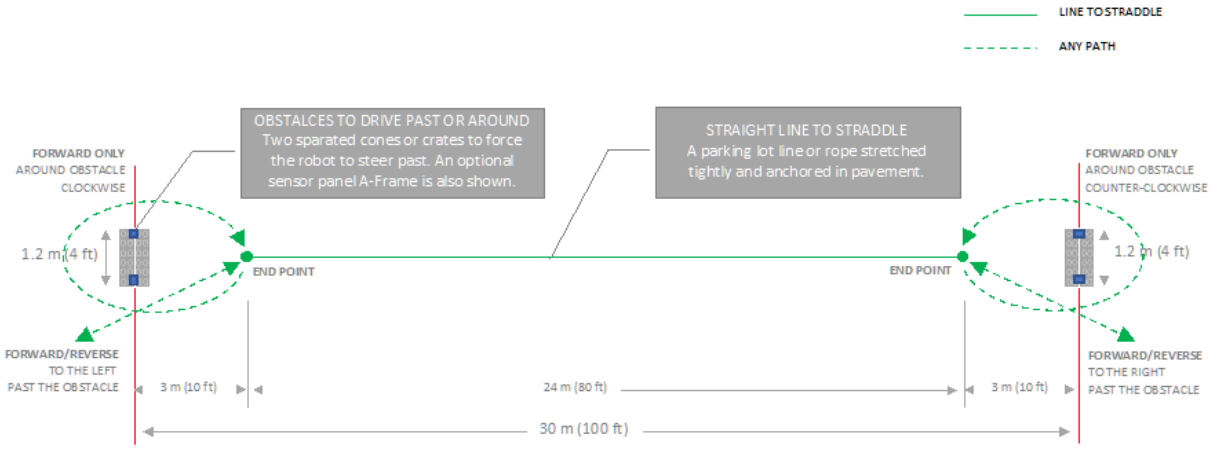
6 tests for basic driving over quite easy terrain completed in forward and reverse driving orientations for teleoperated robots. Autonomous robots may ignore the prescribed orientations and can choose to drive forwards or backwards freely. All tests are mandatory for each robot. All teams (remote pre-recorded, remote live telecon, and in-person) have a fixed time within which to complete as many repetitions as possible.

The lanes are divided into an A-Area (or A-Side), where the robot is “off the test” and can turn around if the test allows, and a B-Area (or B-Side) that is the actual test. Tests start with the robot entirely in the near side A-Area, driving into and through the B-Area, and then into the far side A-Area. Once the robot is entirely within the far side A-Area, for Maneuvering tests the robot may **not** turn around. It should then drive into and through the B-Area, and then into the near side A-Area. This is considered one repetition and scores one point.

(MAN 0) Sustained Speed on a Line:

Motivation:
Evaluate the sustained, controlled speed of the robot, representing the need for the robot to get downrange from a standoff distance.

Picture:



(Note - for RoboCup the distance will be reduced, probably to 10-15 m, given space constraints.)

Procedure:

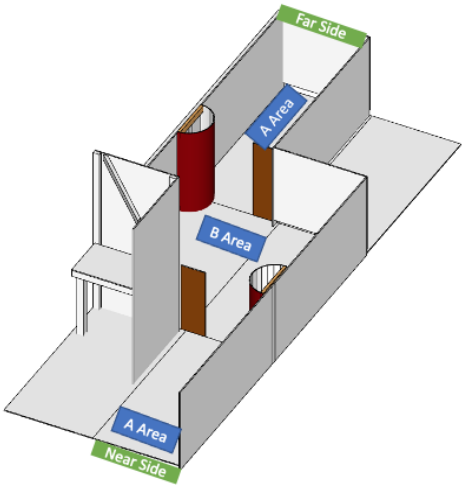
1. Ready the robot in the start square.
2. The trial starts once the start signal is given or the timer is started.
3. Traverse to line/rope.
4. Straddle line/rope while traversing to downrange obstacle.
5. Traverse to the right of the obstacle, circling around the obstacle and aligning with the line/rope.
6. Straddle line/rope while traversing to uprange obstacle.
7. Traverse to the left of the obstacle,circling around the obstacle and aligning with the line/rope.
8. Successful repetition is counted when the robot completely passes the centerline of the obstacle/barrier.
9. Record successful repetition on the scoresheet.
10. Repeat until the end signal or the timer has elapsed.
11. **For in-person and remote live telecon trials only: Perform the readiness test during the prescribed time.**

Faults:
In addition to the standard faults:

- Shifting the start or end obstacles: Considered a full reset.
- Failure to stay on the straight line between obstacles.

(MAN 1) Center Between Objects:

Motivation:
Evaluate the ability of the robot to navigate tight spaces reliably.



Procedure:

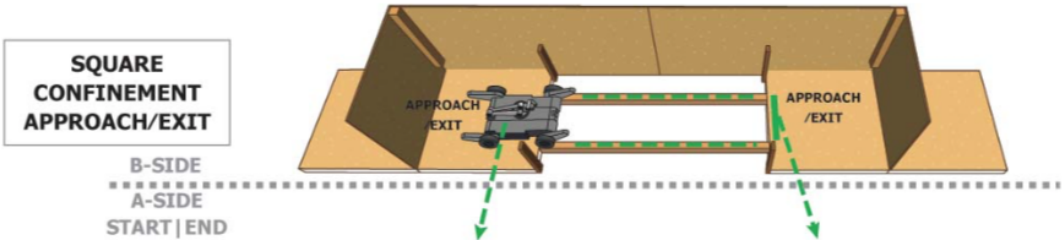
1. Set the width of the doorway
    a. Set doorway width size to 20% wider than the width of the robot.
2. Ready the robot within the A-Area (Near Side)
3. The trial starts once the start signal is given or the timer is started.
4. Traverse forward from A-Area (Near Side) navigating thru B-Area to A-Area (Far Side)
5. Traverse in reverse from A-Area (Far Side), navigating thru B-Area to A-Area (Near Side)
    a. Note: Robot must be completely in A-Area before beginning the reverse route back to A-Area (Near Side)
6. Successful repetition is counted when the robot completely passes into the A-Area (Near Side).
7. Record successful repetition on the scoresheet.
8. Repeat until the end signal or the timer has elapsed.
9. **For in-person and remote live telecon trials only: Perform the readiness test during the prescribed time.**

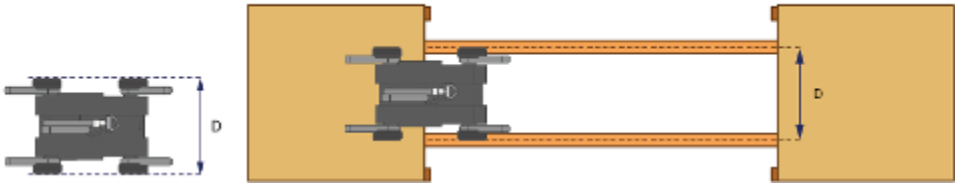
Test-specific Faults:
In addition to the standard faults:

- Shifting the walls: Considered a full reset.

(MAN 2) Align Ground Contacts:

Motivation:
Evaluate the ability of the robot to precisely navigate relative to ground contacts (e.g. to avoid things on the ground such as dropoffs, dangerous substances, or delicate objects).





(Note - rails can be painted blue if necessary for better contrast for autonomous robots.)

Procedure:

1. Set the width of the rails.
    a. Note: Dimensions of the rails and setting the separation distance (D) of the rails to match the overall width of the robot's ground contacts as shown.
2. Ready the robot on the A-Side
3. The trial starts once the start signal is given or the timer is started.
4. Traverse forward from A-Side to B-Side
5. Remotely align robot with rails
6. Traverse across the beams
7. Traverse forward from B-Side to A-Side
8. Traverse in reverse from A-Side to B-Side
9. Remotely align robot with rail
10. Traverse across the beams
11. Traverse in reverse from B-Side to A-Side
12. Successful repetition is counted when the robot completely passes into the A-Area (Near Side).

13. Record successful repetition on the scoresheet.
14. Repeat until the end signal or the timer has elapsed.
15. **For in-person and remote live telecon trials only: Perform the readiness test during the prescribed time.**

NOTE: If your robot has different ground contact widths at the front and back (e.g. you only have flippers at one end, or you have a tricycle arrangement), the rails should be arranged (and/or added) so that a misalignment of approximately 5 cm (2 in) will cause the robot to fall between the rails. Contact the RRL Committee (rescue.robot.league@nist.gov) for any questions.

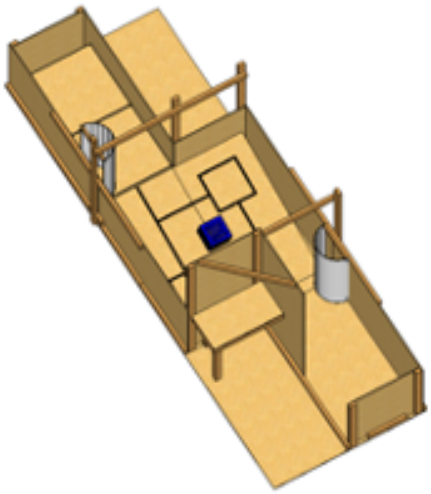
Test-specific Faults:
In addition to the standard faults:

- Falling off the bars (either getting stuck or hitting the ground): Considered a partial reset. Current repetition does not count. Return the robot to the start position (under its own power or otherwise), taking at least 2 minutes. Score does not reset.

(MAN 3) Traverse Incline:

Motivation:
Evaluate the ability of the robot to navigate and avoid obstacles while on a slope.

Picture:



Procedure:

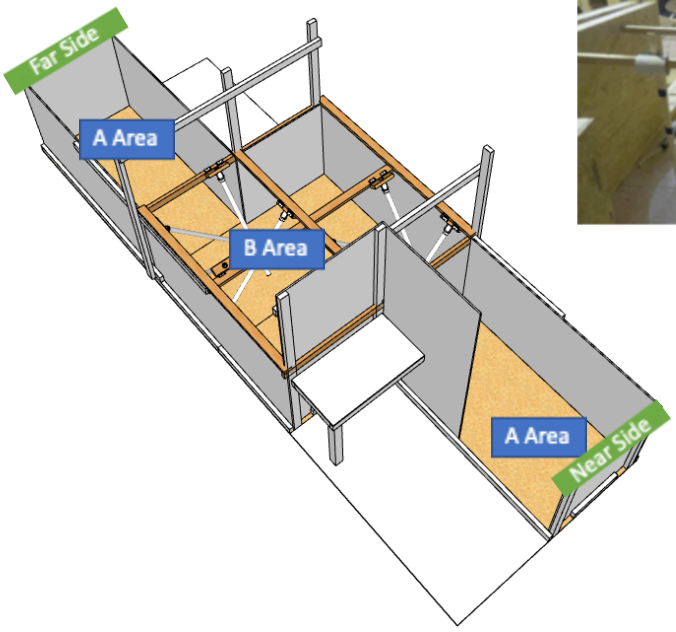
1. Ready the robot within the A-Area (Near Side) .
2. The trial starts once the start signal is given or the timer is started.
3. Traverse forward from A-Area (Near Side) navigating thru B-Area following the prescribed path to A-Area (Far Side).
    a. Robot should drive past the crate before turning.
    b. Line should stay under the robot's ground contacts. The squares at each corner give the robot additional flexibility to maneuver.
4. Traverse in reverse from A-Area (Far Side), navigating thru B-Area following the prescribed path to A-Area (Near Side).
    a. Note: Robot must be completely in A-Area before beginning the reverse route back to A-Area (Near Side).
    b. Robot should drive past the crate before turning.
    c. Line should stay under the robot's ground contacts. The squares at each corner give the robot additional flexibility to maneuver.
5. Successful repetition is counted when the robot completely passes into the A-Area (Near Side).
6. Record successful repetition on the scoresheet.
7. Repeat until the end signal or the timer has elapsed.
8. **For in-person and remote live telecon trials only: Perform the readiness test during the prescribed time.**

Test-specific Faults:
In addition to the standard faults:

- Shifting the walls: Considered a full reset.
- Dislodging the fiducials or crate: Considered a full reset.

(MAN 4) Negotiate Leaning Objects:

Motivation:
Evaluate the ability of the robot to navigate among obstacles that entangle the chassis.



Procedure:

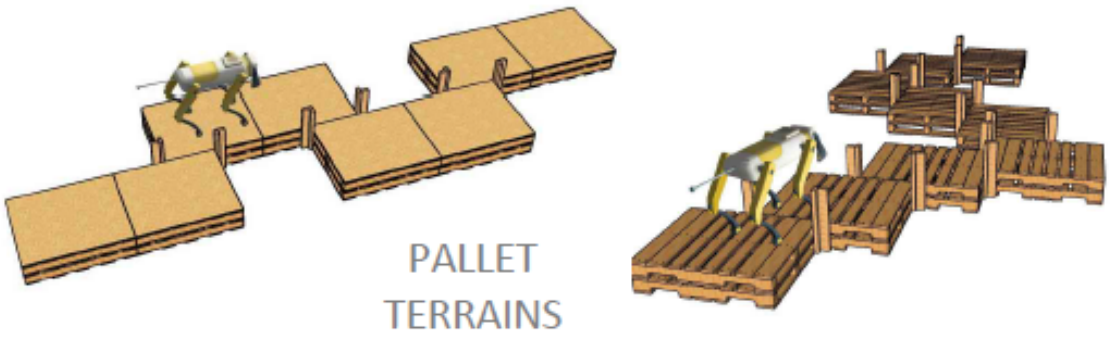
1. Ready the robot within the A-Area (Near Side) .
2. The trial starts once the start signal is given or the timer is started.
3. Traverse forward from A-Area (Near Side) navigating thru B-Area to A-Area (Far Side).
4. Traverse in reverse from A-Area (Far Side), navigating thru B-Area following the prescribed path to A-Area (Near Side).
    a. Note: Robot must be completely in A-Area before beginning the reverse route back to A-Area (Near Side).
5. Successful repetition is counted when the robot completely passes into the A-Area (Near Side).
6. Record successful repetition on the scoresheet.
7. Repeat until the end signal or the timer has elapsed.
    a. For in-person and remote live telecon trials only: Perform the readiness test during the prescribed time.

Test-specific Faults:
In addition to the standard faults:

- Hitting pipes hard enough to dislodge or break them: Considered a partial reset. Current repetition does not count. Repair the arena and return the robot to the start position, taking at least 2 minutes. Score does not reset.

(MAN 5) Pallet Terrain:

Motivation:
To evaluate the ability of the robot to maneuver, ideally autonomously, in an environment with both positive and negative obstacles.



Procedure:

1. Set the width of the doorways
   a. Set doorway width size to 20% wider than the width of the robot.
2. Ready the robot within the A-Area (Near Side).
3. The trial starts once the start signal is given or the timer is started.
4. Traverse forward from A-Area (Near Side) navigating thru B-Area to A-Area (Far Side).
5. Traverse in reverse from A-Area (Far Side), navigating thru B-Area to A-Area (Near Side)
   a. Note: Robot must be completely in A-Area before beginning the reverse route back to A-Area (Near Side).
6. Successful repetition is counted when the robot completely passes into the A-Area (Near Side).
7. Record successful repetition on the scoresheet.
8. Repeat until the end signal or the timer has elapsed.
9. **For in-person and remote live telecon trials only: Perform the readiness test during the prescribed time.**

Test-specific Faults:
In addition to the standard faults:

- Shifting the posts: Considered a full reset.
- Touching the floor outside the apparatus: Considered a full reset.