WRO®
WORLD ROBOT OLYMPIAD ™

RoboMission

Senior Game Rules
Season 2024

Earth Allies
Force of Nature

Official Game Rules for WRO RoboMission Senior.
Version: January 15th 2024
(Note: Rules for local WRO events may vary!)

WRO International Premium Partner

LEGO education™

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Important information for reading this document:

- These game rules are made for local and national competitions.
- National Organizers in WRO countries are allowed to simplify the missions.
- For the International Final, one extra mission will be released on October 8th 2024. The extra challenge will work with the same game mat and brick set. It is not mandatory to do this extra mission to participate in the event.
- Because of possible surprise rules and the extra mission for the International Final, the game field may contain areas and markings that are not used at local or national events.
- For greater clarity, the robot missions are explained in multiple sections. But the teams can decide which missions they will do and which order.
- The game missions have easy and more complicated tasks. This makes the competition suitable for beginning and more experience teams. It is not necessary to solve all missions to enjoy a WRO participation.
- General information on game table setup and fixing of game objects on the field you find in the WRO RoboMission General Rules, chapter 6.

We wish everyone much success and a lot of fun with our WRO 2024 challenges!

Your team of World Robot Olympiad Association

1. Introduction

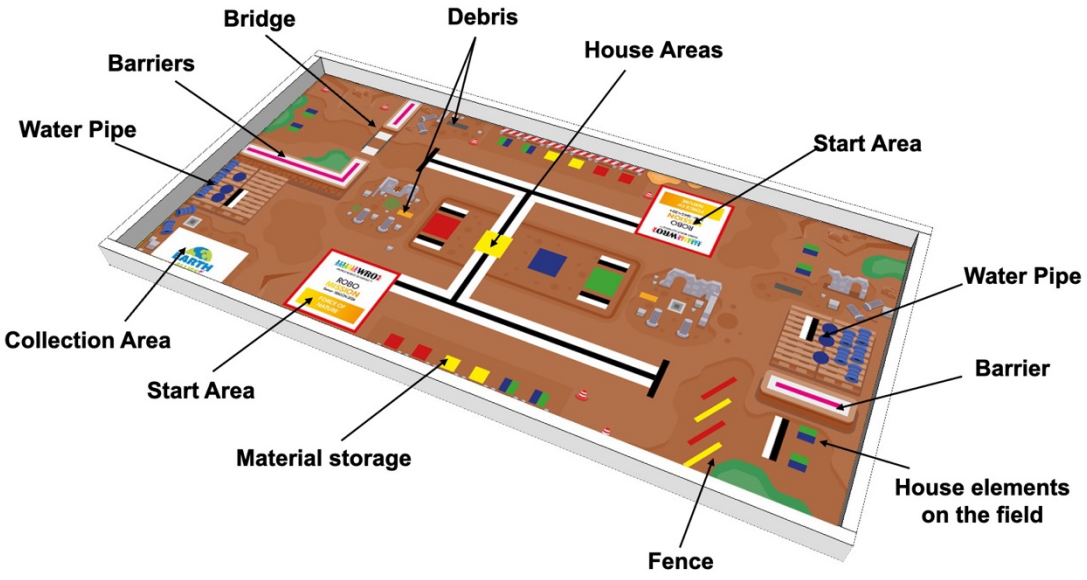
The forces of nature are powerful and unpredictable. We need to be prepared for the possibility of major disasters in many places in the world where people live. We need to develop new technologies and strategies to help us mitigate the effects of these disasters and to rebuild our communities after they occur.

Robots are an example of one of these new technologies. They can help to warn us in advance for a coming disaster. They can also help us to prevent excess damage from and to help with rescues and rebuilding after a disaster has hit.

On the Senior game field, the robot will help restoring a city after a natural disaster. The robot will rebuild houses, clean the streets from debris and will repair water pipes.

2. Game Field

The following graphic shows the game field with the different areas.



If the table is larger than the game mat, centre the mat in all directions.

3. Game Objects, Positioning, Randomization

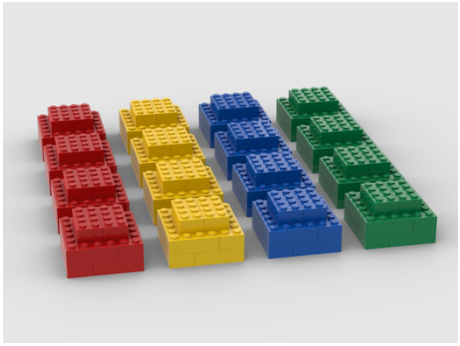
Randomization of the start area

There are two start areas on the game field. **On the day of competition**, one start area is selected for the full day. Teams will then start from this area and the placements of some house elements (see next) will align with that.

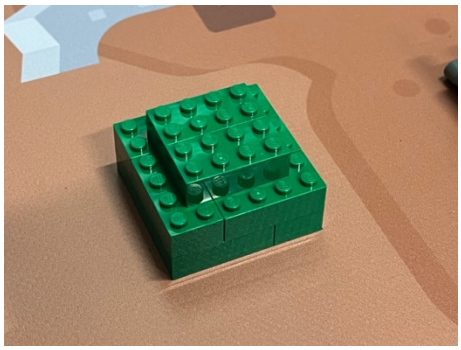
House elements

There are 16 house elements (4 red, 4 yellow, 4 blue, 4 green) on the field:

- **4 red and 4 yellow house** elements **will always be placed** next to the two different start areas
- **4 blue and 4 green house** elements **will be randomized** and placed on the different positions on the field: 2 elements top-left, 2 top-right, 2 bottom-right and 2 elements next to the start area of the competition day

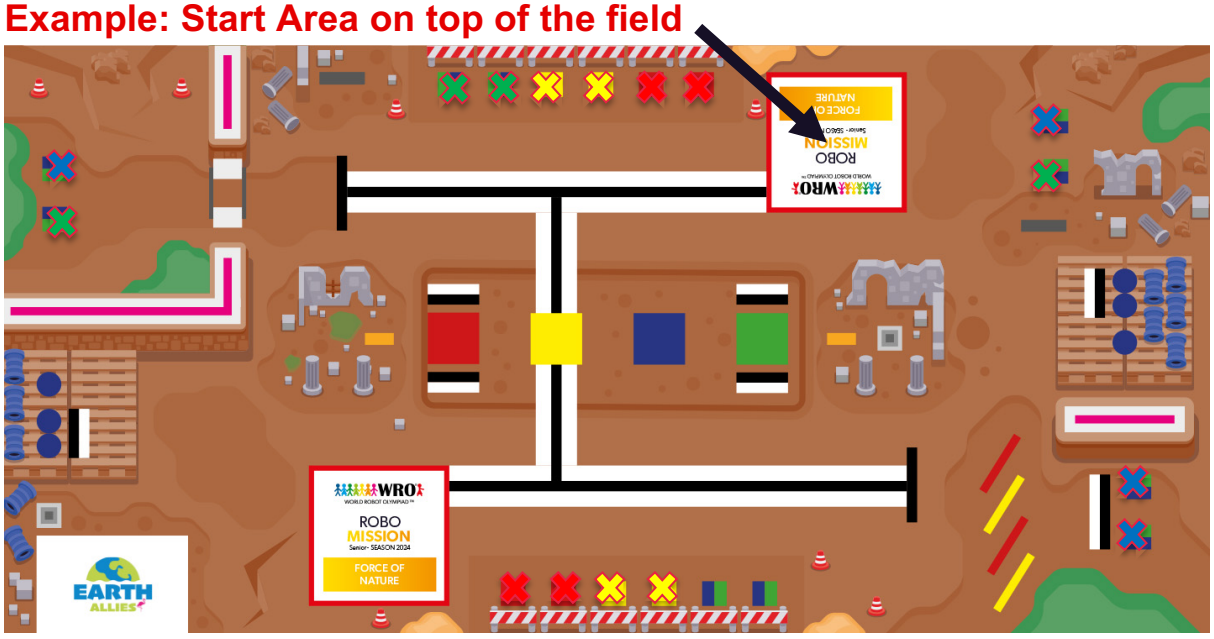


House elements



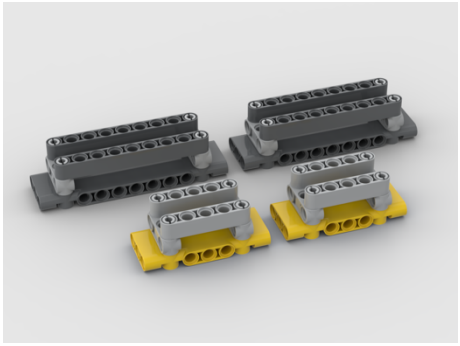
Example of a house element on a start position

Example: Start Area on top of the field

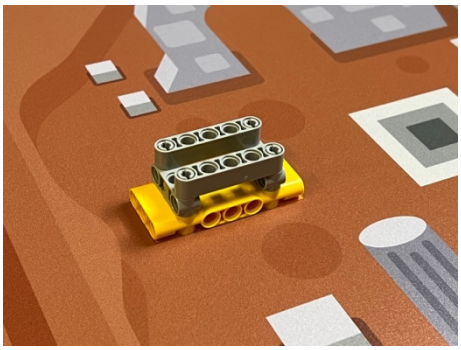


Debris elements

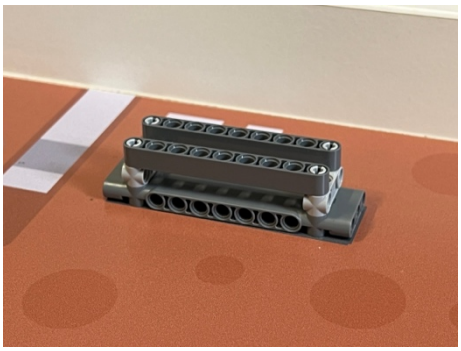
There are **4 debris elements (2 yellow, 2 dark grey) on the field.** They are always placed on the orange and grey rectangles on the game field.



Debris elements



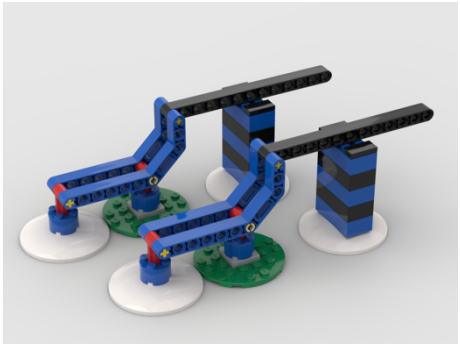
Position of yellow debris element



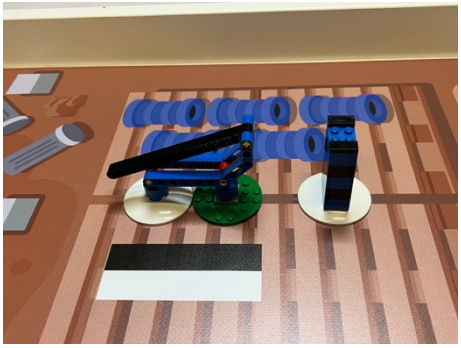
Position of dark grey debris element

Water Pipes

There are **2 water pipes** on the game field. The different parts are always placed on the blue circles on the field, all elements will be <u>fixed to the mat</u>.



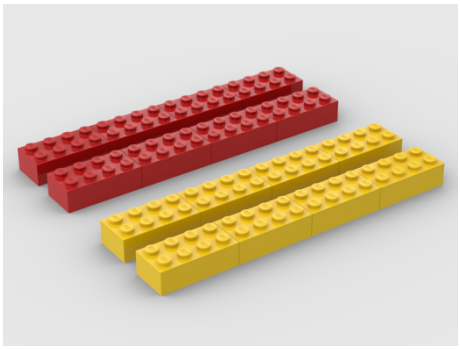
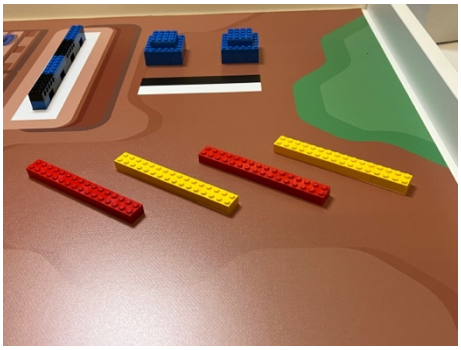
Water pipes (in connection)



Water Pipe setup on the field (not connected, all parts fixed to the mat)

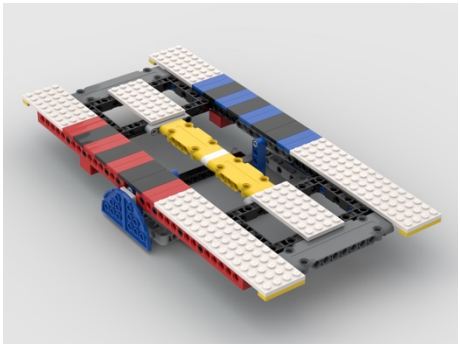
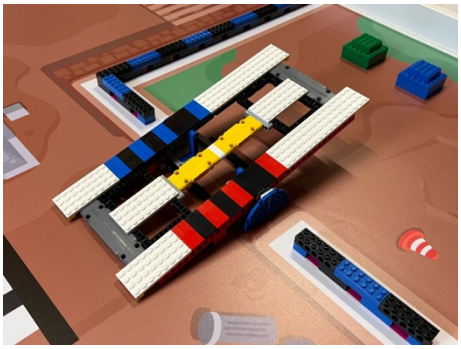
Obstacles

There are 16 individual 2x4 LEGO bricks (8 red, 8 yellow) that are fixed on the game mat as obstacles for the robot.

 Obstacles	 Placement of obstacles (fixed to the mat)

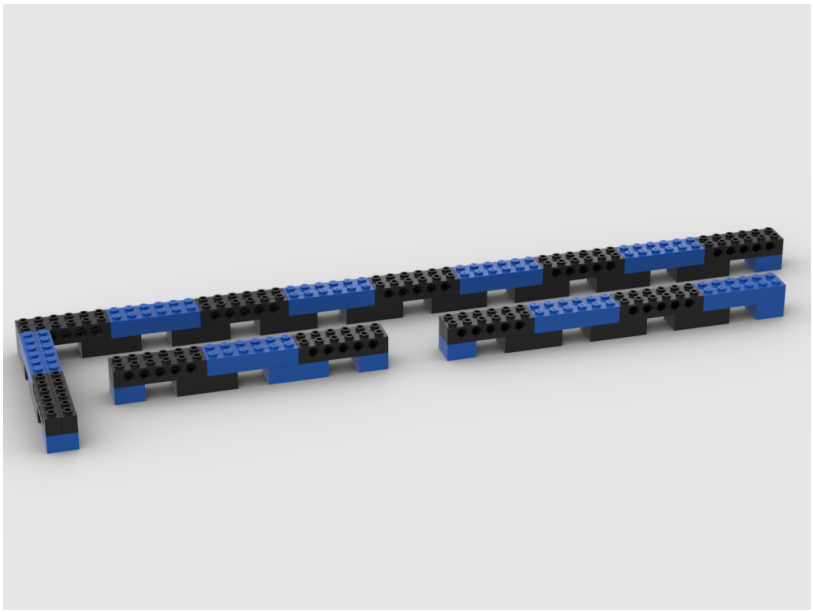
Bridge

There is a bridge on the way to the top-left corner. The bridge is always placed with the lower side looking to the start area and will be fixed on the mat.

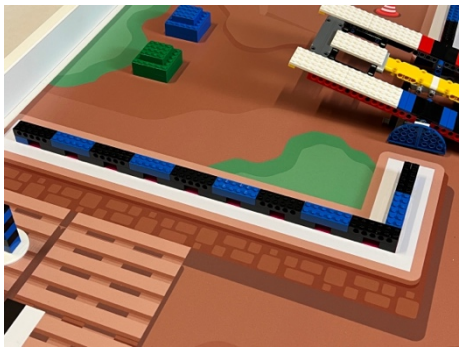
 Bridge	 Bridge on game field (fixed to the mat)

Barriers

There are **3 barriers** on the game field (2 surrounding the top-left corner, one on the right side of the game field). All barriers should not be to be moved or damaged.



Barriers



Placement around top-left area

Placement around top-left area

Placement on the right side

4. Robot Missions

4.1 Rebuild houses

The robot should help rebuilding houses after an earthquake in the city:

- 4 houses – one in each colour (red, yellow, green, blue) – should be built in the different coloured areas on the field (e.g. red house in red area).
- Every house can have four floors. Maximum points are awarded if all four houses are built with 4 house elements of the colour matching the colour of the area below.

For the scoring of the house elements please note the following:

- The lowest element (floor 1) must always be completely inside a coloured house area and the colour of the lowest floor element must match the colour of the area, otherwise no points are awarded for the entire house. Completely means that the game object is only touching the coloured area.
- All house elements must always be stacked with the studs facing upwards. House elements cannot be upside down or on the side.
- House elements stacked on the 1st element can only be supported by the element below it. They cannot be supported by anything else, like the floor or another element.
- Only one house per coloured area counts. If there are two houses in an area that could score points, then the house with the most points will be scored.

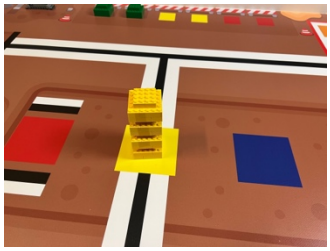
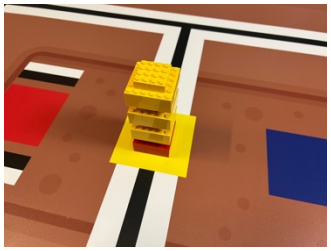
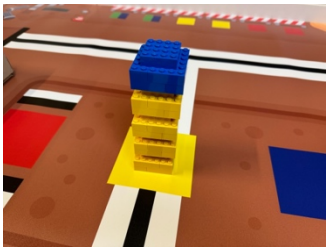
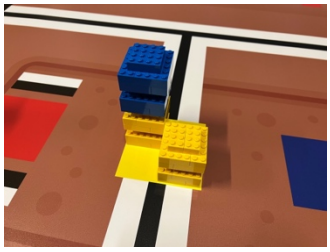
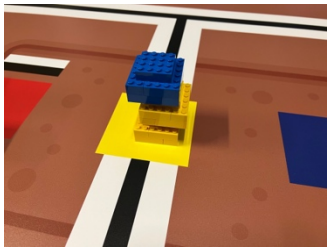
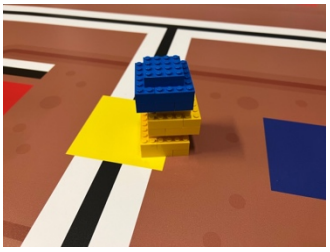
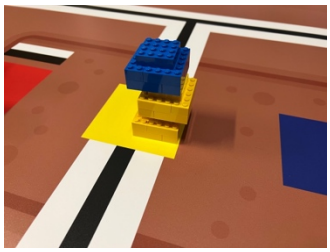
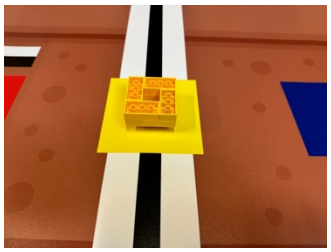
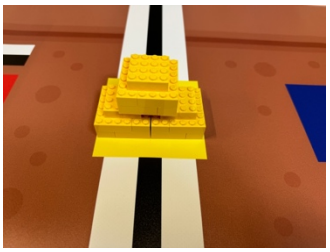
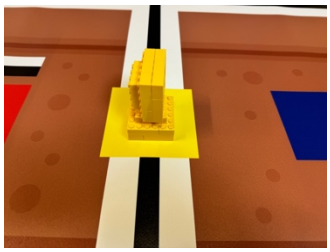
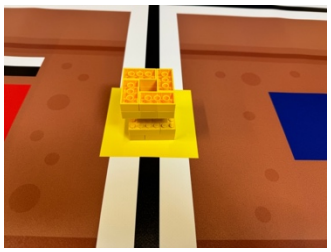
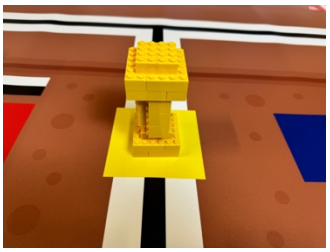
The following table shows the scoring of this task and the photos show scoring situations that apply for all kind of coloured houses.

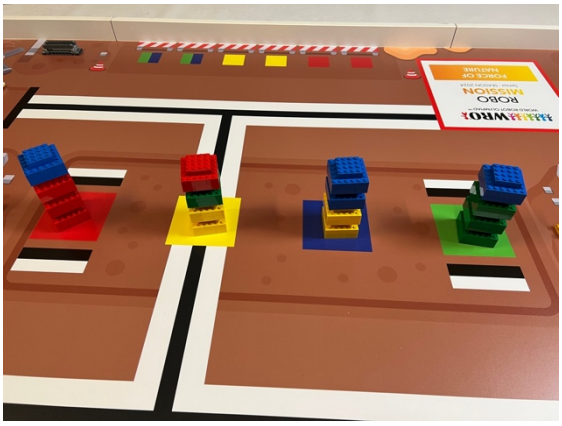
	Each	Max.
House with one floor	3	
OR: House with two floors	6	
OR: House with three floors	10	
OR: House with four floors	**14**	**56**
Additionally: House with exactly 4 floors + all elements have the same colour as the coloured area below.	**8**	**32**

3 points (one floor)

6 points (two floors)

10 points (three floors)

 14 + 8 points (4 floors + only yellow + correct area)	 0 points (floor 1 element is red and not yellow)	 14 points, no extra points because house should have exactly 4 floors
 14 points (only one house, with more points, counts)	 10 points (3 floors, does not matter that they are shifted to the left and right on top of each other)	 0 points (floor 1 is not completely in the coloured area)
 10 points (3 floors, floor 1 is completely in and it is OK if the other floors are outside in projection view)	 0 points (studs not up)	 3 points (only for one element in first floor)
 3 points (only for one element in first floor)	 3 points (only for one element in first floor)	 3 points (only for one element in first floor)

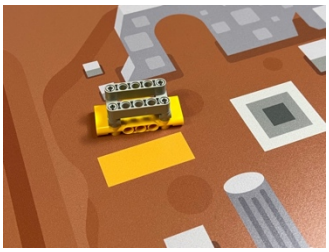
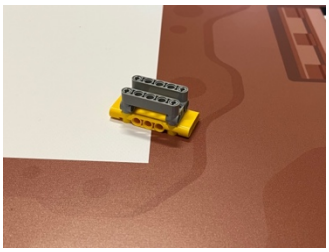
 56 + 32 points – ideal solution, all houses are completely built (4 floors) and placed in the correct coloured area.	 3x14=42 points (the house in the blue area do not score points because the lowest element is not matching the color)

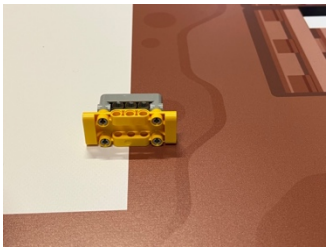
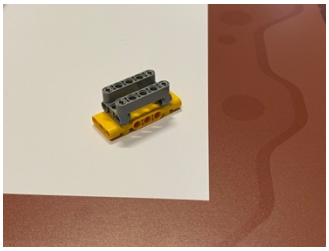
4.2 Clean Debris

In the city, some debris is lying around and the robot should help collecting it. Full points are awarded if the debris is touching the collection area in the bottom-left of the game field.

The following table shows the scoring of this task and the photos show scoring situations that apply for all kind of debris elements.

	Each	Max.
Debris is not touching the coloured area (yellow area for small debris, grey area for big debris) anymore and not touching the collection area	**2**	
Debris is touching the collection area	**5**	**20**

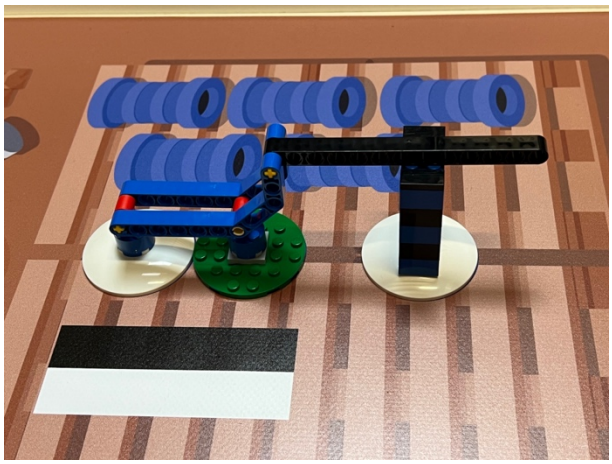
 2 points (not touching the coloured area and not touching the collection area)	 0 points (still touching the coloured area)	 5 points (touching collection area)

 5 points (touching collection area, ok if lying on side)	 5 points (completely in collection area)	

4.3 Repairing water pipes

The water pipes in the city are not functioning anymore and the robot should repair the pipes. Full points are awarded if one part of the water pipe was tilted to the other and with that, the water pipe is reconnected. The following table shows the scoring of this task and the photo show the scoring situation for this task.

	Each	Max.
Water pipe repaired (element touches the other element)	**8**	**16**

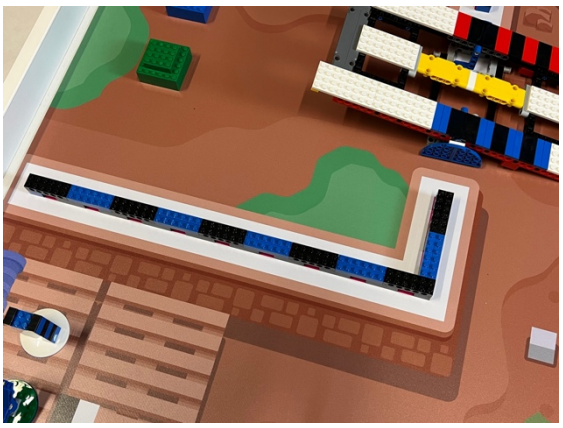
 8 points (water pipe connected)	

4.4 Bonus for barriers

Barriers should not be moved outside of the white surrounding area and should not be damaged. If those objects are not damaged and not moved (outside of the white surrounding area), you will always get the bonus points.

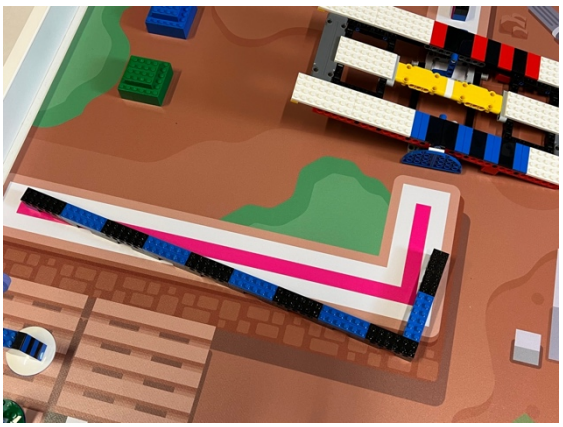
The following table shows the scoring of this task and the photos show scoring situations that apply for all of barriers.

	Each	Max.
Barrier not moved or damaged	**7**	**21**

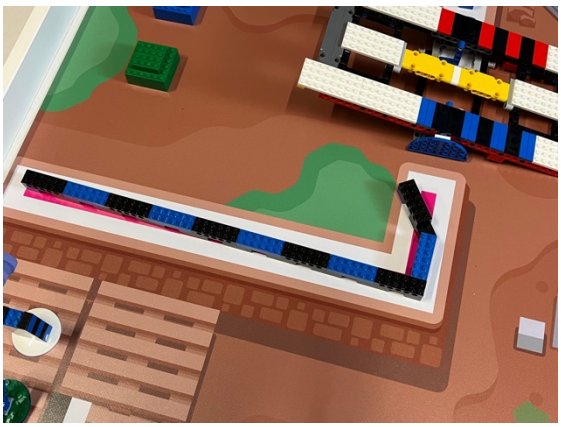


7 points (not moved)

7 points (moved inside white surrounding area)



0 points (moved outside white area)



0 points (damaged)

5. Scoring Sheet

Team name: _____ **Round: _____**

Tasks	Each	Max.	#	Total
Rebuild houses ▪ Only points for any house if the lowest floor is completely in a coloured area and the lowest floor is matching the colour of the coloured area. ▪ Only one house, the one with more points, counts per coloured area.				
House with one floor	3			
OR: House with two floors	6			
OR: House with three floors	10			
OR: House with four floors	**14**	**56**		
Additionally: House with exactly 4 floors + House only coloured with elements of the colour matching the coloured area.	**8**	**32**		
Clear Debris				
Debris is not touching the coloured area (yellow area for small debris, grey area for big debris) anymore and not touching the collection area	2			
Debris is touching the collection area	**5**	**20**		
Water Pipes				
Water pipe repaired (element touches the other element)	**8**	**16**		
Bonus for barriers				
Barrier not moved or damaged	**7**	**21**		
Maximum Score		**145**		
			Surprise Rule	
			Total Score in this run	
			Time in full seconds	

In case a game object is damaged, please see the RoboMission General Rule 6.8.