



## SETTING THE SCENE

The cranes are working to build a new bridge to replace the old Champlain Bridge linking the island of Montreal to the south shore of the St. Lawrence River. Opened in 1962, the bridge is showing signs of wear more quickly than expected. The type of concrete used during the construction allowed water and salt to seep in, which damaged the metallic structure.

The old bridge must remain in use until the new bridge is ready. This means that repair work must be done periodically.

You have been chosen to ensure the safety of workers who need to repair a section of the bridge as well as the expansion joints. To do this, you must design a robot capable of moving traffic cones on its own to allow vehicles to use one of the bridge lanes while workers work on the other lane.

Will the workers be safe?



## GENERAL FUNCTION OF THE ROBOT

You will need to design a robot that can move the cones situated on one side of the playing surface one by one to the other side of the surface to protect the workers who are repairing the bridge.

Depending on the White or Black level, one or 2 cement mixers and workers are in the green rectangles. The robot must avoid hitting them.

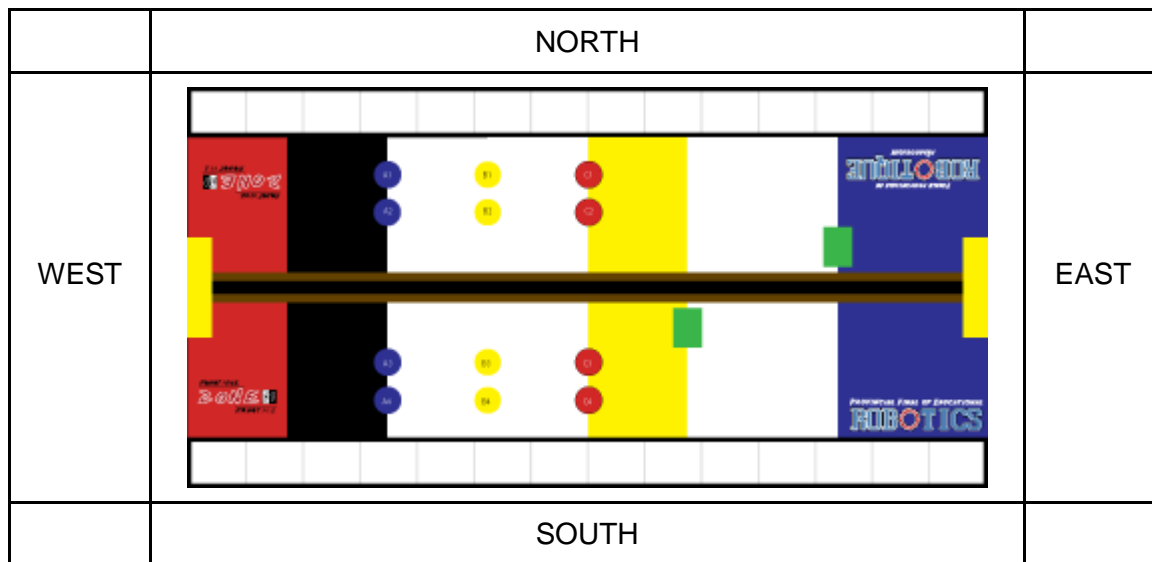
## DESCRIPTION OF THE ROBOT:

The dimensions of robots participating in this challenge must not exceed the following limits:

- A. Initial length: 30 cm
- B. Initial width: 30 cm
- C. Height: no limit
- D. Mass: no limit

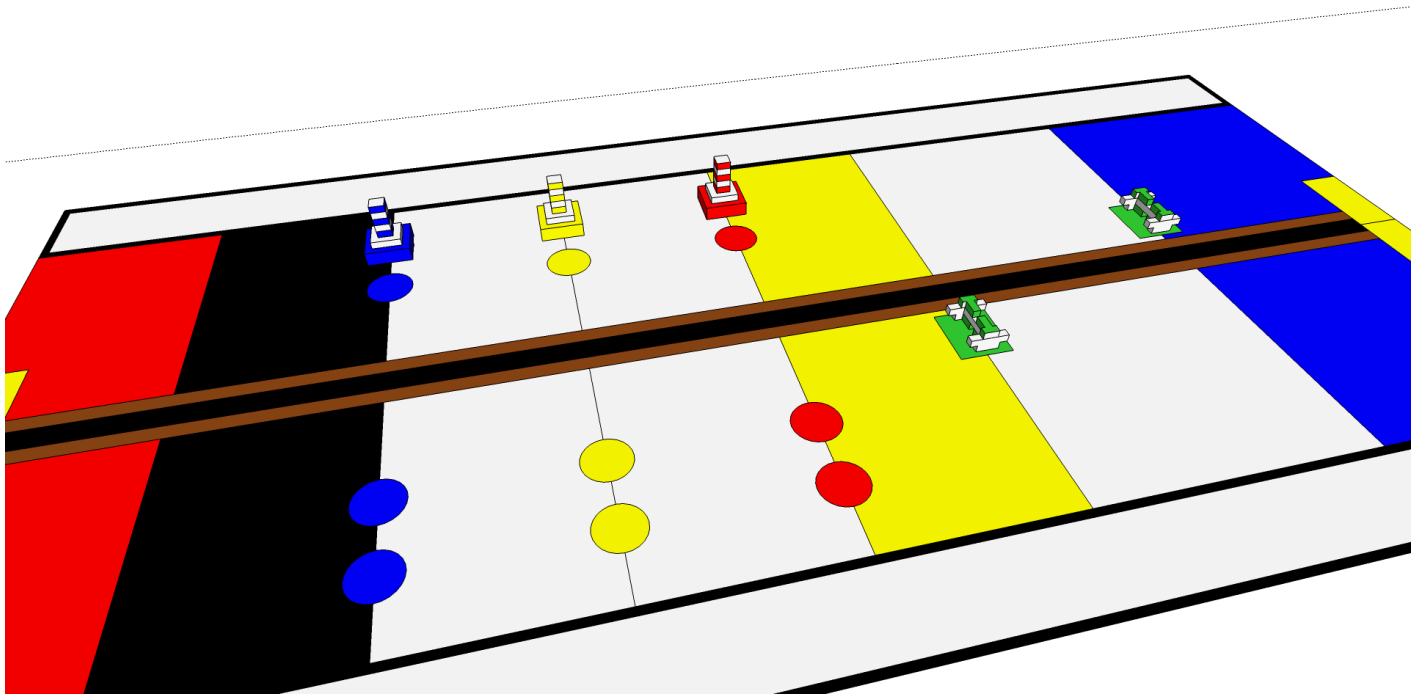
## DESCRIPTION OF THE SURFACE AREA:

Surface used: Z01-A mat



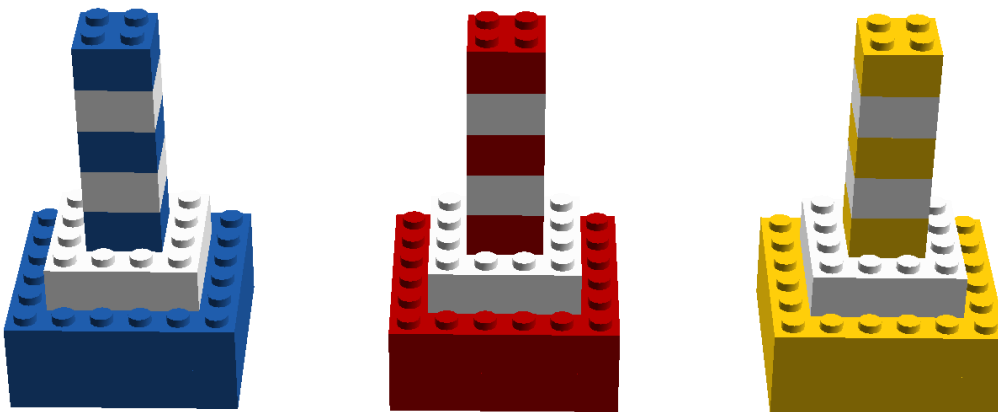


## Surface view in 3D:



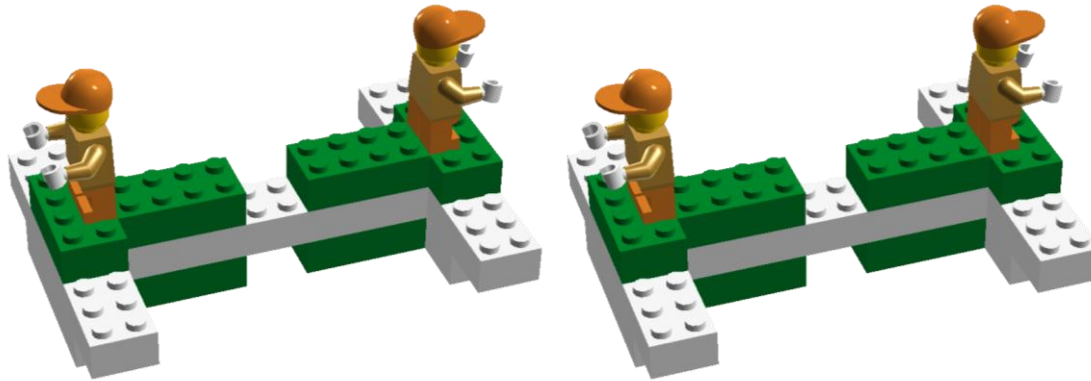
## Description of accessories:

### a. Traffic cones



There are 3 traffic cones, 1 blue, 1 red and 1 yellow.

### b. Concrete mixers and workers



There is one concrete mixer and 2 workers in the green rectangle in the South zone for the White level.  
There is one concrete mixer and 2 workers in each green rectangle for the Black level.

### DETAILED DESCRIPTION OF THE CHALLENGE

WHITE level	BLACK level
The White level of this challenge is for beginner teams. The challenge is kept as simple as possible by keeping the problems to solve to a minimum. For students with more experience, we recommend the Black level.	The Black level of this challenge is for teams with more experience. Students encounter the challenges of designing and programming at their level.
<b>Time allowed</b>	
2 minutes	
WHITE level	BLACK level
Programming: <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Design: <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Strategy: <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Programming: <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Design: <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Strategy: <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>Recommended hardware</b>	
1. Colour sensor 2. Distance sensor (optional)	
<b>The challenge step by step</b>	



WHITE level	BLACK level
1. The team puts its robot down anywhere in the departure area (red).	
2. The judge places each of the 3 cones in the circle of the same colour on the North side of the playing surface in A1, B1 and C1.	2. The judge places each of the 3 cones in a circle of a <b>different colour</b> on the North side of the playing surface in A1, B1 and C1.
3. At the signal, the judge starts the timer and the team starts its robot.	
4. The robot then moves toward the cones in the North zone which it must move one by one toward the South zone. It cannot be in possession of or touch two cones simultaneously.	
5. It must move the cone of its choice to the circle of the <b>same colour</b> in the South zone in A4, B4 and C4. The cone must touch the coloured circle to be considered in the circle.	
6. The robot has to repeat the same sequence for the remaining 2 cones.	
7. The robot must go to the finish area (blue) and avoid hitting the concrete mixer and the workers who are in the green rectangle in the South zone. The cement mixer will be considered to have been hit if it is no longer completely in its rectangle.	7. The robot has to go to the finish area (blue) and avoid hitting the concrete mixers (and the workers) who are in the green rectangle in the South zone. The mixer will be considered to have been hit if it is not completely in its rectangle.
8. The timer is stopped when the robot is completely in the arrival area or when the team says STOP. If the robot leaves the surface before the timer is stopped, a penalty will be applied.	

## SCORING

	MAX PTS
10 points per cone moved from its original location (3)	30
<i>5 points per cone placed in the circle of the wrong colour in South zone (3)</i>	15
<i>15 points per cone placed in the circle of the same colour in the South zone (3)</i>	45
15 points for avoiding the concrete mixer and workers (Black level = avoid the cement mixers by passing between the green rectangles)	15



10 points for ending in the finishing area	10
<b>Total</b>	<b>100</b>

## PENALTIES

If the robot leaves the surface BEFORE the timer stops	-10
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## SUGGESTED STRATEGIES

WHITE level	BLACK level
1. Make sure you can control the rotations of the robot around itself	1. Make sure you identify the colour of the cones in order to put them in the right place