REPUBLIC OF TURKEY

MINISTRY OF NATIONAL EDUCATION

The General Directorate of Technical and Vocational Education

13. INTERNATIONAL MEB ROBOT CONTEST LINE FOLLOWER ROBOT CATEGORY RULES

2019 - SAMSUN

LINE FOLLOWER ROBOT CATEGORY RULES

1) Objective

Line follower robots are designed to able to follow white line on black ground or vice versa autonomously. They are commonly used for carry the goods from one place to another in industry It is just enough to draw only lines on ground of plant to do this. The most important points for line follower robots are correct program, hardware control and speed.

In this category, autonomous line follower robots try to finish courses in shortest time and faultless by following white line on black ground or black line on white ground.

- At elimination race, aim is to finish the course in best time and with minimum penalty points and to take place in ranking list of first 64 robots.
- At final race , aim is to finish the course earlier than it's rival.

2) ELIMINATION COURSE

2.1 Details

- Lines are indicated by white color with black ground.
- Tracks which have 400mm width, 5mm thickness are made by black and white opaque PVC foam. Joints between parts that made up the track are covered with black opaque foil.
- Lines are made by using white and black opaque foil through the middle of the track with 20±2 mm width.The distances from these lines to edge of track are 200±5 mm for both sides.
- Roads consist of white on black ground.
- There is a seesaw bridge on the track.
- The width of all parts of seesaw bridge is 400 mm.
- The angles of ramp and slope of seesaw bridge are 15^0 ±4
- Track on the seesaw bridge is white line on black ground
- Lines on the seesaw bridge are made by using white and black opaque foil through the middle of the track with 20±2 mm width.The distances from these lines to edge of track are 200±5 mm for both sides.
- During elimination race, an obstacle will move forward-backward through 1000mm line. Location of moving obstacle may be different for each competitor.
- Dimensions of this moving obstacle is 100mmX100mmX100mm.
- Color of this obstacle is white.
- There are 3 starting lines (Figure 8) in elimination race.
- Line 1 is placed 400mm far from the front edge of track.
- Line 2 is placed 700mm far from the front edge of track.
- Line 3 is placed 1000mm far from the front edge of track.
- Time sensors are placed 1200mm far from the front edge of track and 10mm above at out of track.
- **In elimination race, which starting line would be used for each robot will be determined by drawing lots on judge desk. Competitors draw lots by themself.**
- There will be two elimination tracks in the contest area as to be symetrical to each other. So they are called track-A and track-B

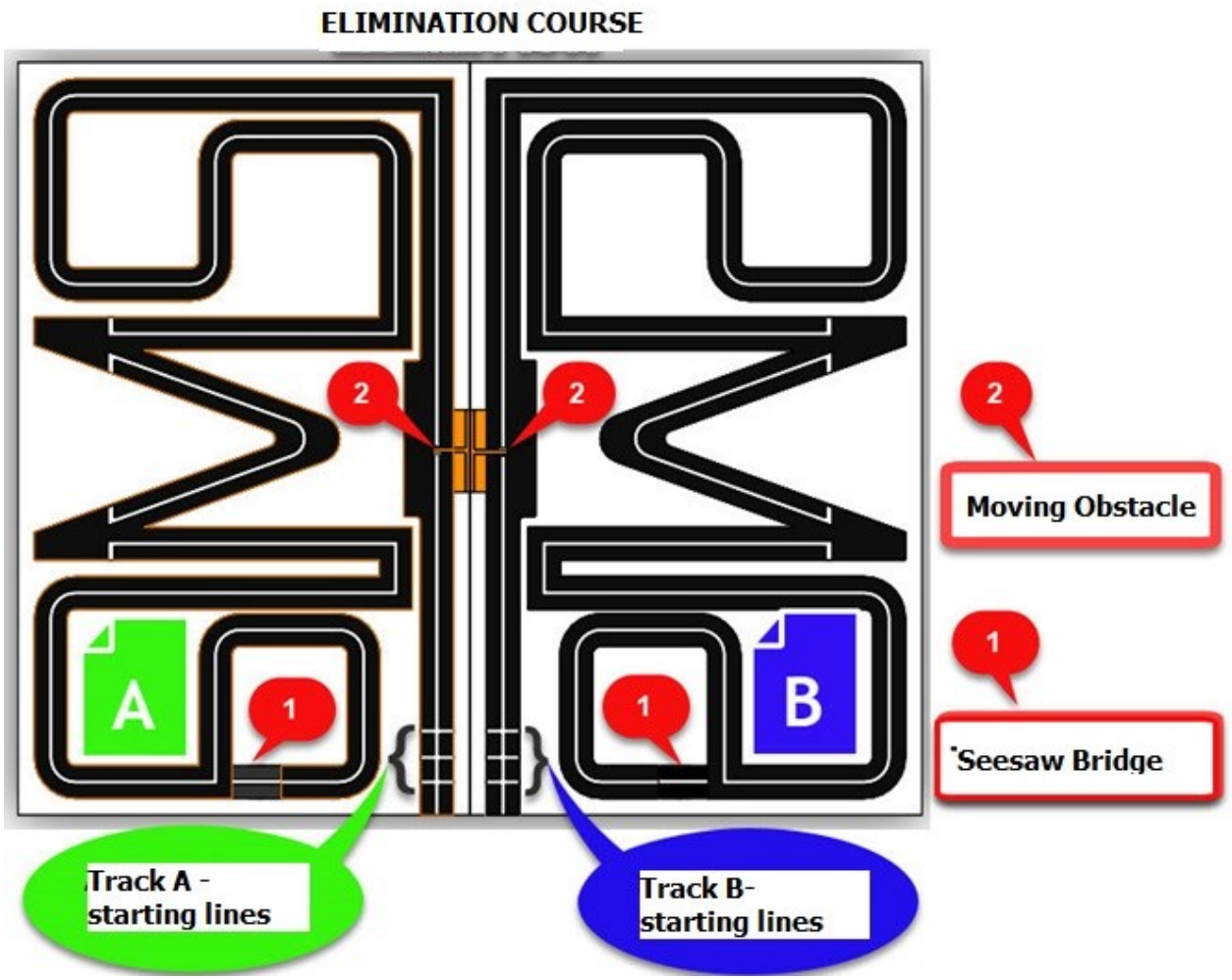


Figure-1: Elimination course view

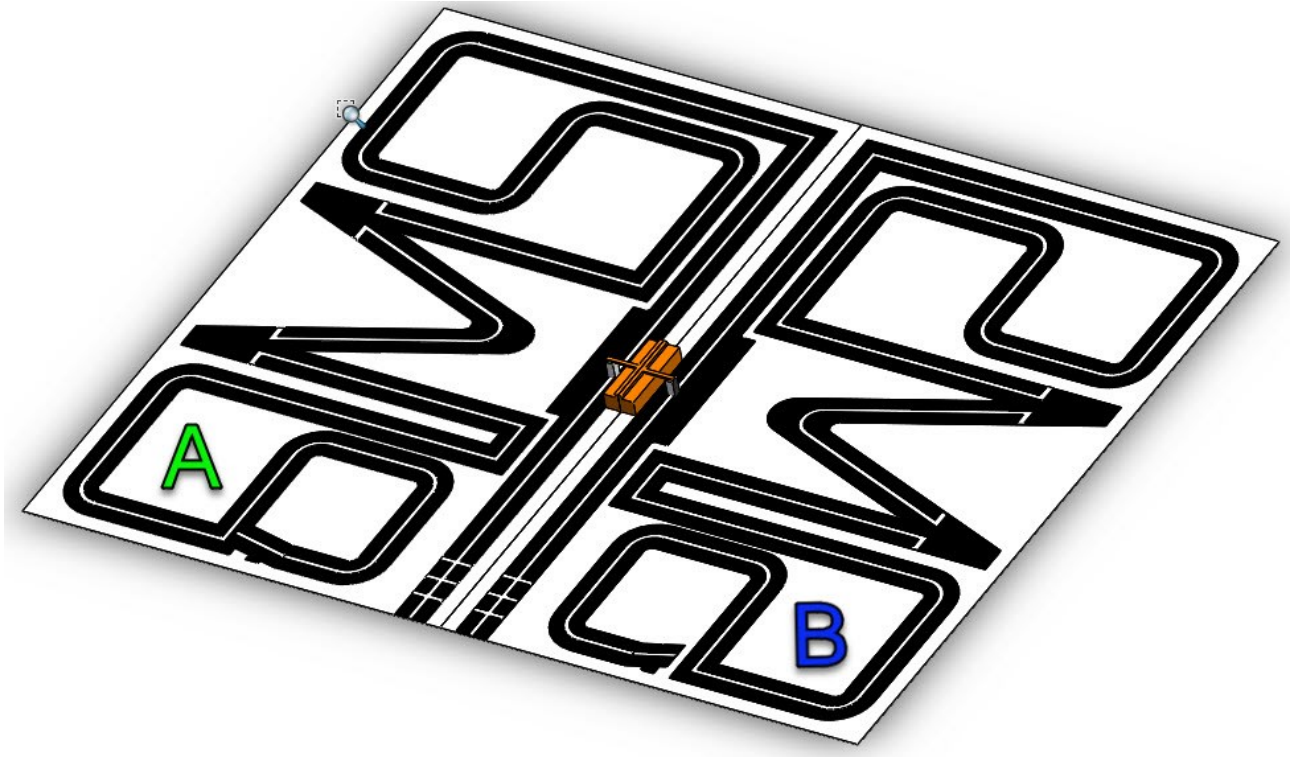
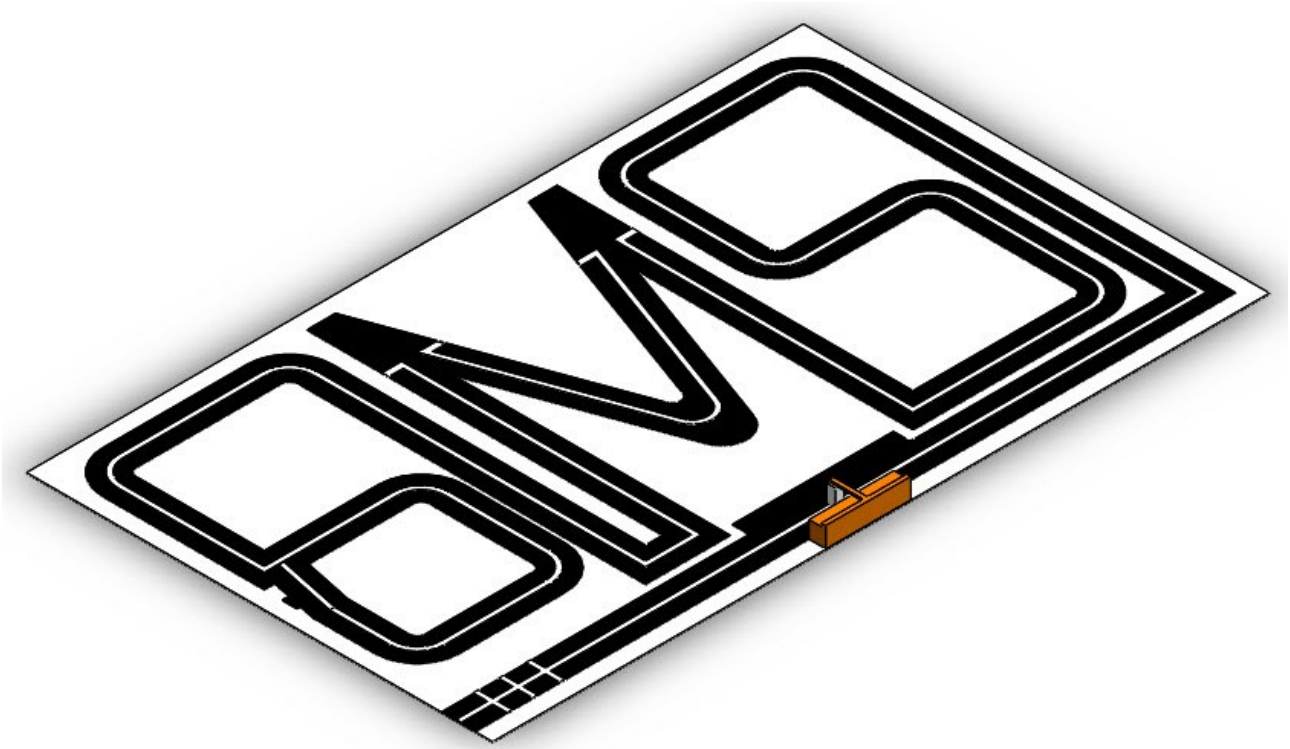


Figure-2: Elimination course 3D view



Şekil-3: Tek eleme pistinin 3D görünüşü

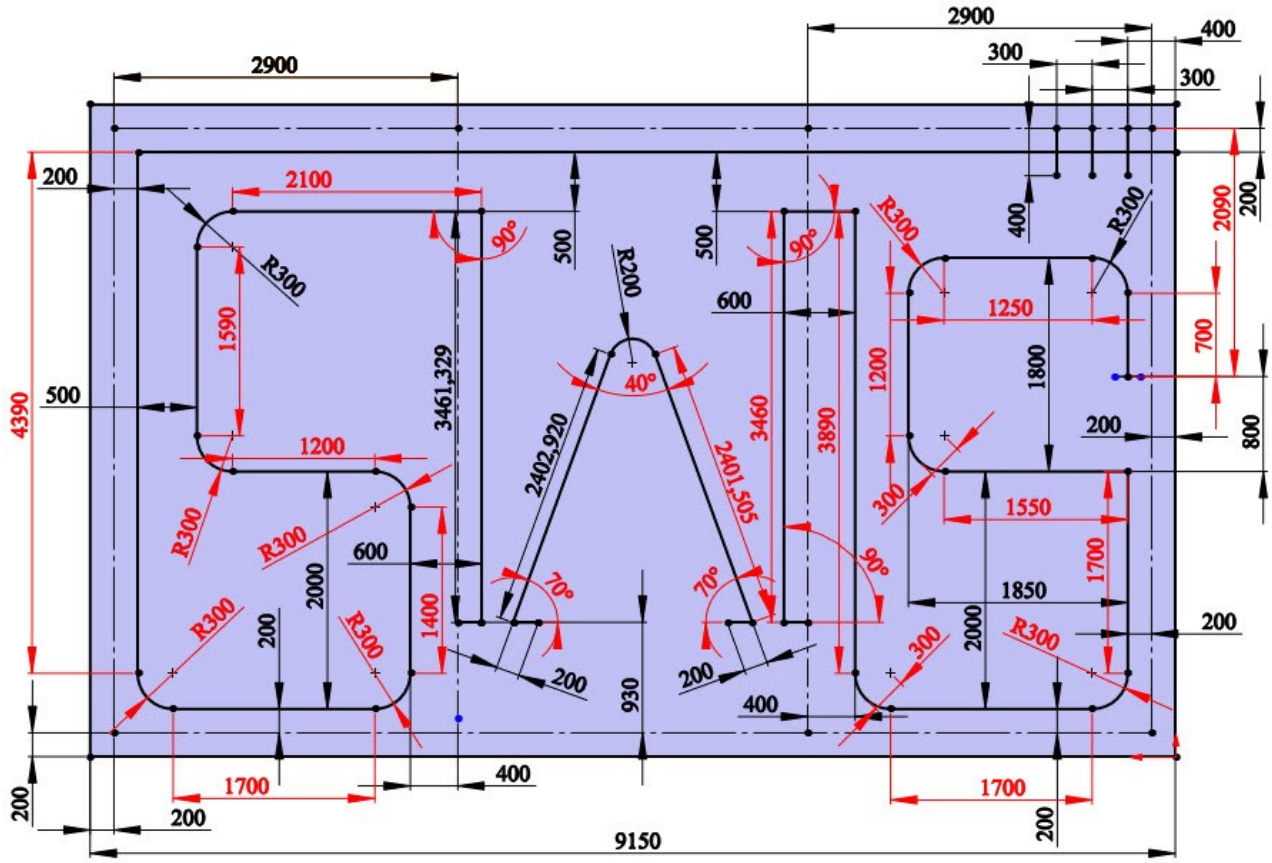


Figure-4: Dimensions of Elimination Course

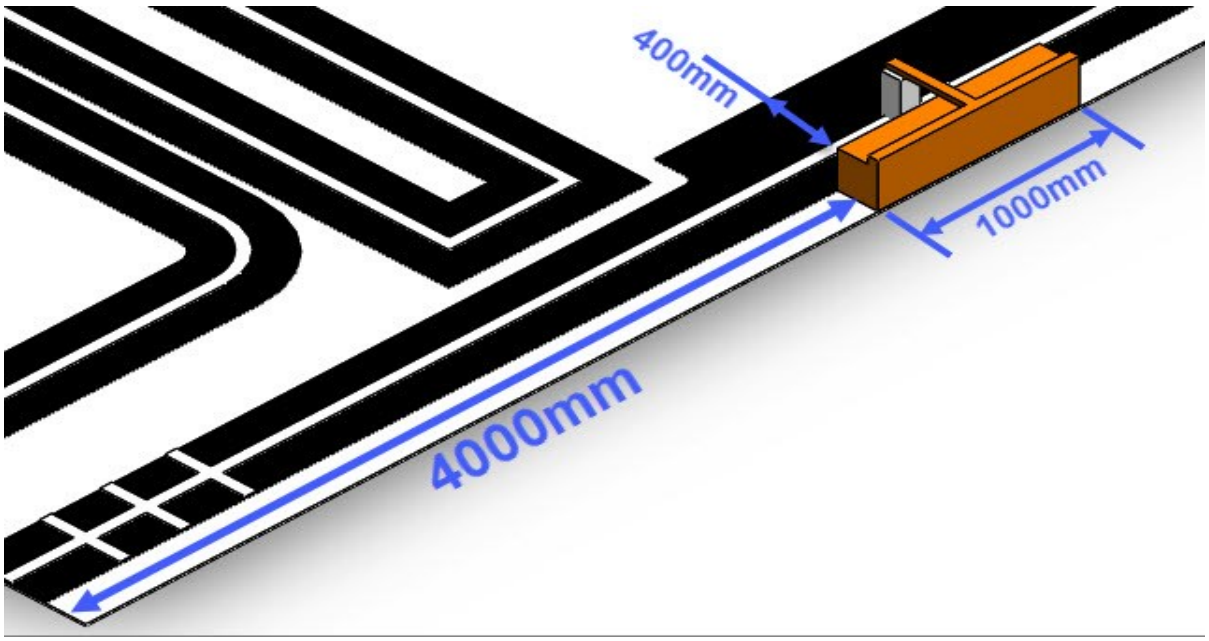


Figure 5: Position of moving obstacle

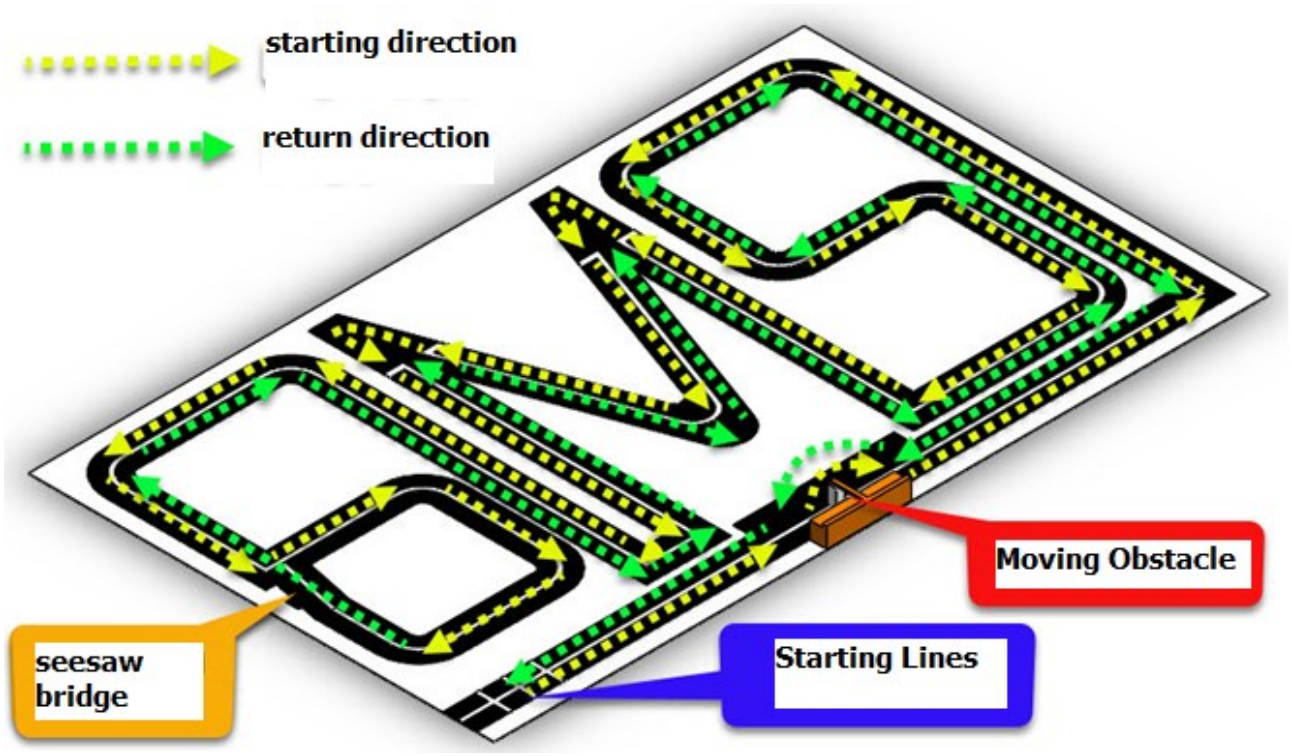


Figure 6: Route directions of line follower robot

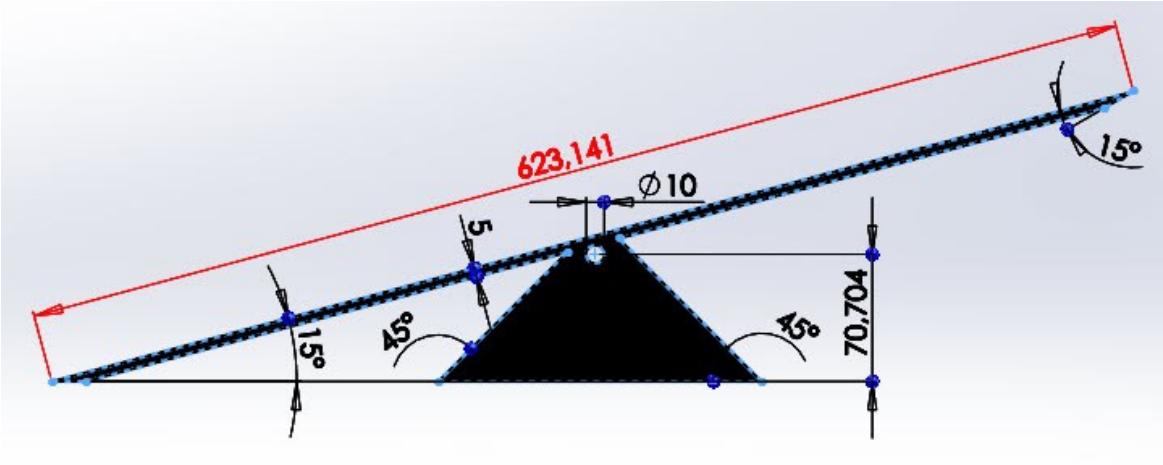


Figure 7: Seesaw bridge dimensions

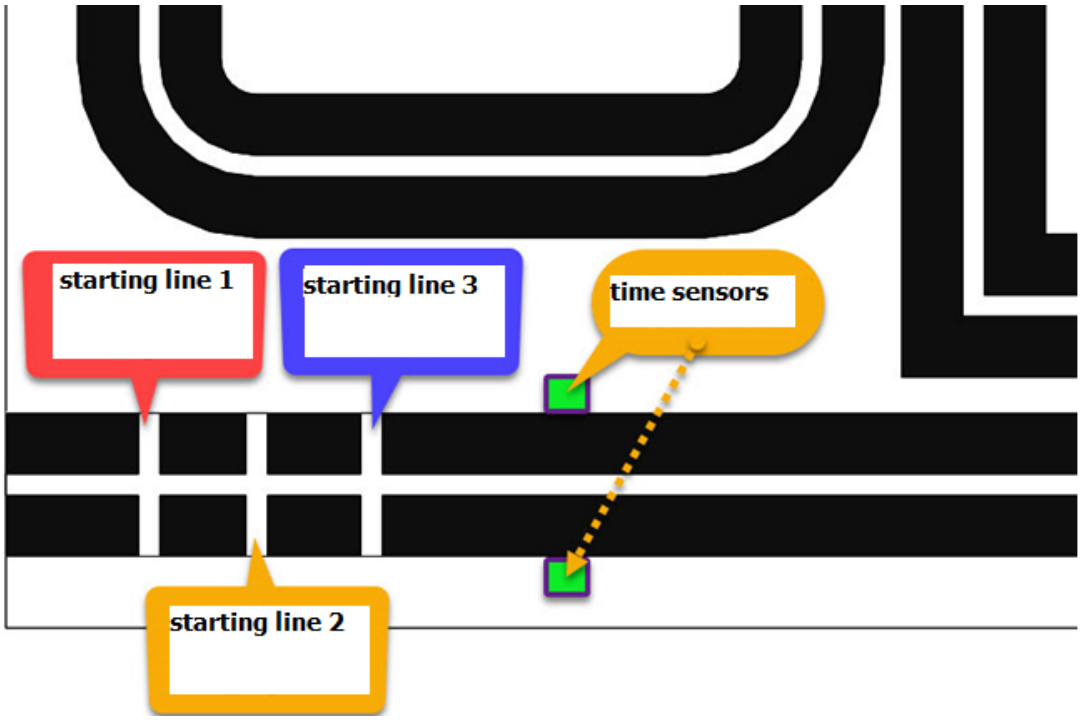


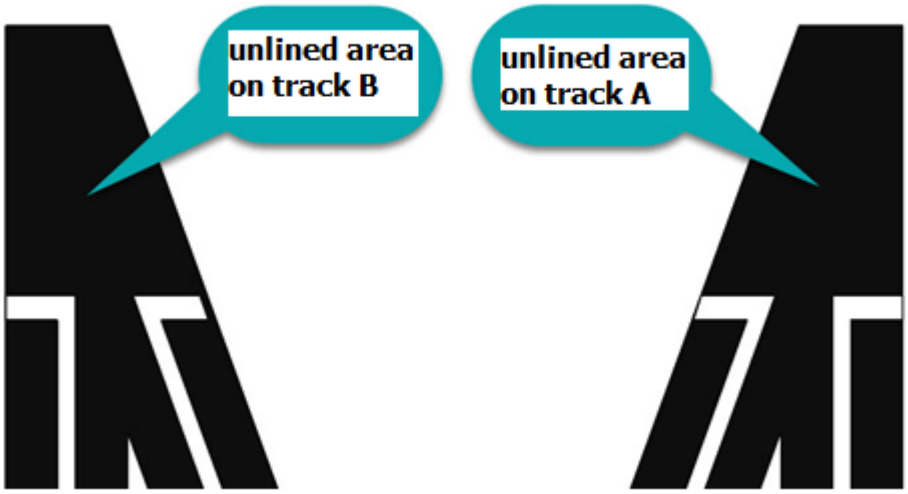
Figure 8 : Starting lines and numbers

Elimination Race

- Each robot will run one by one. The order of competitors is determined by the draw lot. Which track will be used by robots is also determined according to this draw lot. (Track A or Track B)
- **After determining tracks of competitors, starting line of robot is determined by another draw lot. Competitor draws lot by own. (1,2 and 3 starting lines)**
- Robots complete one lap on the track.
- Race will be held against the time. Lap time will be recorded by choronometer.
- There will be sensors placed 10mm above and 1200mm inner from the front edge of track to determine lap start and end. When the robot passes through the starting line, chronometer will start by the help of sensors.
- Time penalty (10sec) is given to the robot which couldn't start and the robot takes the starting position again. The robot has 3 rights for starting. **(for each unsuccessful start will be punished seperately with 10sec time penalty)**
- When the robot is completely out of track, it will be put back manualy on just right place where robot out of. Time doesn't stop in this case. No intervention rights given unless the robot out of route completely. This right may be given only by judges and

10sec time penalty is also given in this case. **Robot which is out of track 5 times will be disqualified.**

- If robot cannot climp up the seesaw bridge, it is placed on track after the bridge then robot gets **20sec**.penalty. **(it is not assumed as fail "out of track")**
- If robot drops from the seesaw bridge while climbing up or down, In this case, robot is placed on the track after bridge then robot takes **20sec.**penalty. **(it is not assumed as fail "out of track")**



- If robot arrives unlined area and cannot find its way, robot is placed by competitor to correct direction. It is assumed as "out of track". In this case , both **10sec penalty for "out of track "** and **20sec penalty for "losting direction"** is given.
- When robot hit the seesaw bridge from wrong direction , it gets **10sec penalty for "out of track "**. Robot is placed by competitor to correct direction.
- **Able to go final race, robot must finish the race and enter ranking list of first 64 robots**

4) FINAL COURSE

5) Details

- Tracks are formed as white line on black ground.
- Tracks which have 400mm width, 5mm thickness are made by black opaque PVC foam. Joints between parts that make up the track are covered with black opaque foil.
- Lines are made by using white opaque foil through the middle of the track with 20±2 mm width.The distances from white line to edge of track are 200±5 mm for both sides.
- Tracks are formed as white line on black ground.
- There is a seesaw bridge on route.
- The width of seesaw bridge is 400 mm.
- The angles of ramp and slope of bridge are 150 ±4
- Tracks on the bridge are formed as white line on black ground.
- Lines on the bridge are made by using white opaque foil through the middle of the track with 20±2 mm width.The distances from white line to edge of track are 200±5 mm for both sides.
- There is a starting / ending line. This section has 800mm width and distance between two tracks is 400mm. Both distances from lines to sides of ground are 200mm This line is placed 500mm far from the front edge of track.
- Sensors aligned with starting / ending line are placed 10mm above at out of track.
- For both competitors, there is white colored automatic gate which is 150mm top of starting line. Robots will be placed to starting line and wait for opening the gate.
- When judge presses the button, gate will open and race will start.

- Sensor will detect the robot which come first to finish line and its finish lamp near the track will be turned on. Even the other robot passes through the finish line, its lamp won't be turn on, therefore winner of race will be exactly determined.

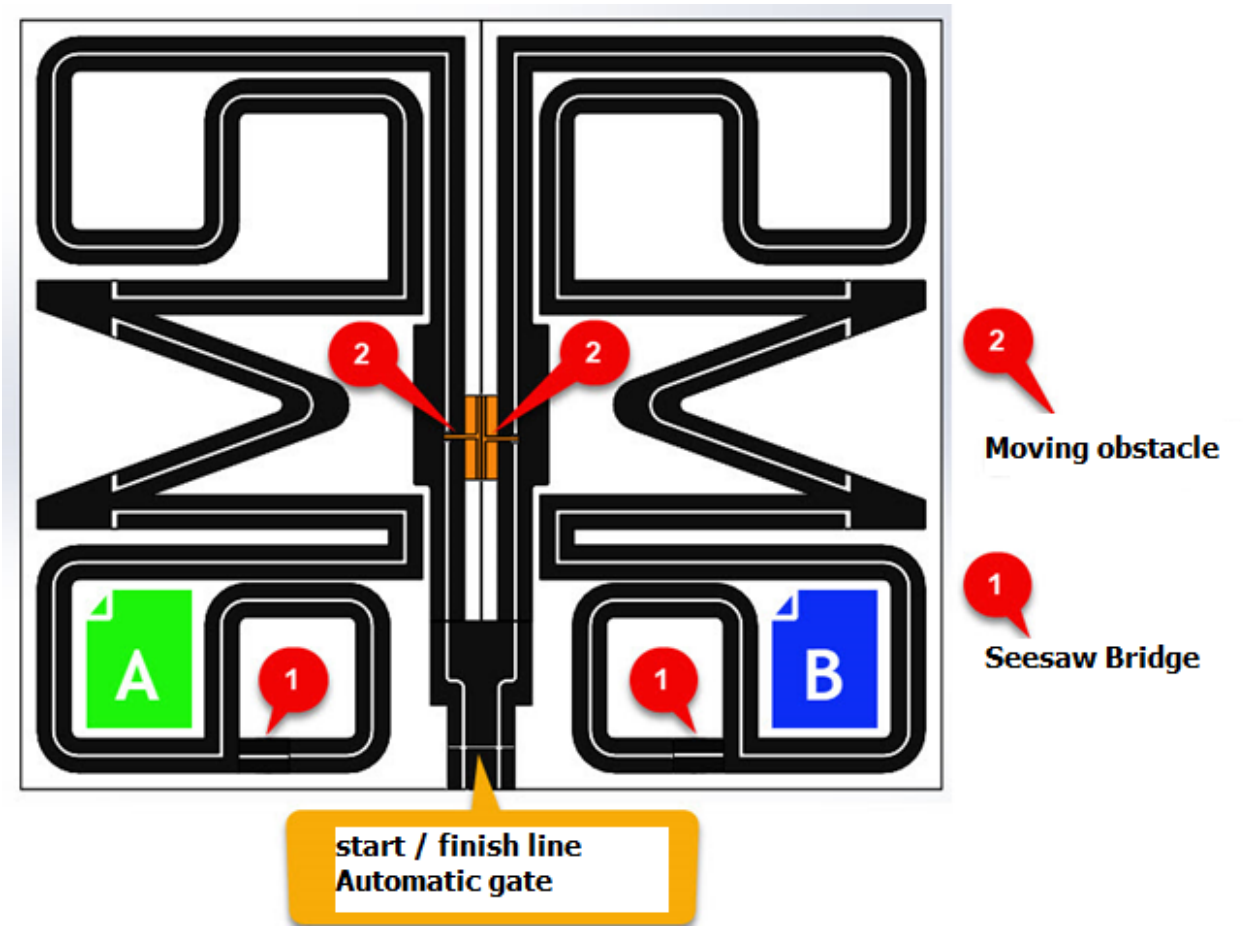


Figure -9: Final Course

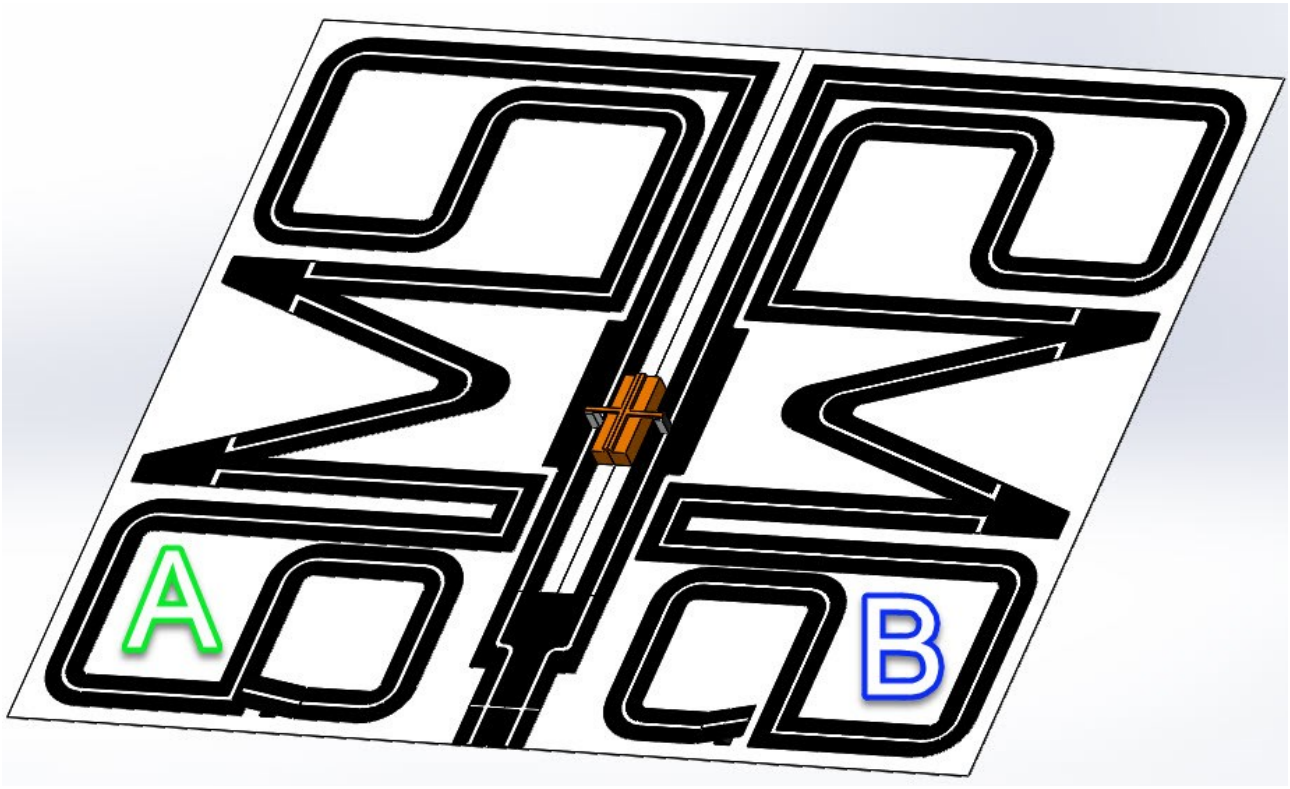


Figure -10 Final course 3D view

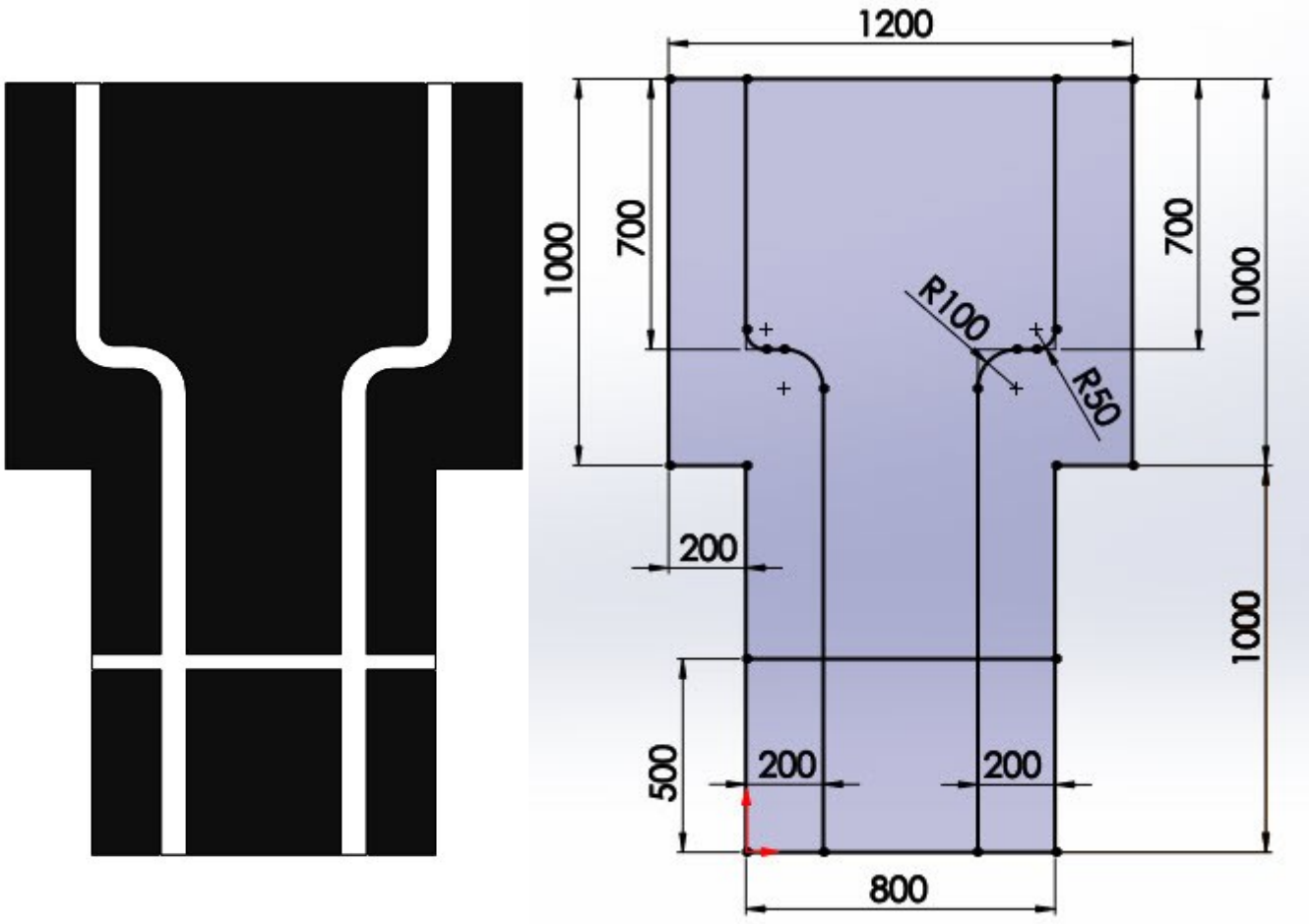


Figure -11 : Final course starting section dimensions

6) Final Race

- **Maximum 64 robots** which success to enter the ranking list of the elimination race gain rights to race on final track.
- Elimination method will be used in this stage. Therefore two robots will compete at the same time.
- Race order is determined by the draw lot. Track is determined by judge at the moment of just before starting.
- Both robots are put in front of starting line. *The starting line is 500mm far from the gate.*
- Race starts when judge opens the automatic gate.
- When one of robots cannot run, it is waited until the other robot passes moving obstacle. After that ,if judge gives permission, it is placed manually to the gate for starting. **This case is assumed as "out of track"**
- During the race, if any robot goes out of track , they can continue to the race by placing manually at the same of point after desicion of judge. **This case is assumed as "out of track"**
- If robots hits the seesaw bridge from reverse direction , it is placed to correct direction manually and continue to race. **This case is assumed as "out of track"**

- **Robots which are out of track four times, they will be disqualified. Each intervention of judge will be assumed as out of track.**
- Race will end when the lamp of robot arriving first turns on.
- In case of the robot is disqualified, . the other robot is regarded as winner of race without wait for finishing.

7) Other Rules

- Any time for break or maintenance will not given to the teams.
- The height of robot must be maximum 120mm because of automatic gate.
- It is not allowed to put any sign or mark permenantly on the track or to damage it. Robots which damage the track will be disqualified.
- Robots can use any kind of energy source which doesn't cause to damage the track and injury the spectators.

8) Assesment

✓ **Elimination:**

Robots are ranked according to their time penalties and finishing race.
In case of equal scores, the robot which has less penatlies comes first compared the other. If scores are still equal, robot that is lighter than other will be selected.

✓ **Final :**

- After the elimination session, first 64 robots will get right to compete at final course.

- Robots will race by twos. Matching will be done by draw and one of robot will be eliminated.
- This elimination progress will continue like 16,8,4 etc. until remaining 2 robots. These two robots will be race for becoming winner. Their rivals will race again for third place.

Dimensions of tracks can be slightly different than images because of production process.

There may be led displays , ligthing equipments or recording equipments around competition area. Any objections which based on these reasons will not be accepted.

Competition organisation comittee has rights to make all kinds of modifications about the rules of contest in case of necessaries.

13. International MEB Robot Contest / Line Follower Robot Category Assesment Sheet

LINE	Robot	Penalty for unsuccessful start					Number of out of track, Hitting the bridge from reverse direction, Losting direction in unlined area,					Penalty for unable to climb up seesaw bridge	Penalty for dropping from seesaw bridge	Penalty for losting direction	TOTAL PENALTIES	Time of chronometer	**Total time**
		Number of unsuccsessful start				**10 sec**	Number of "out of track"				**10 sec**	**20 sec**	**20 sec**	**20 sec**	**20 sec**		
1																	
2																	
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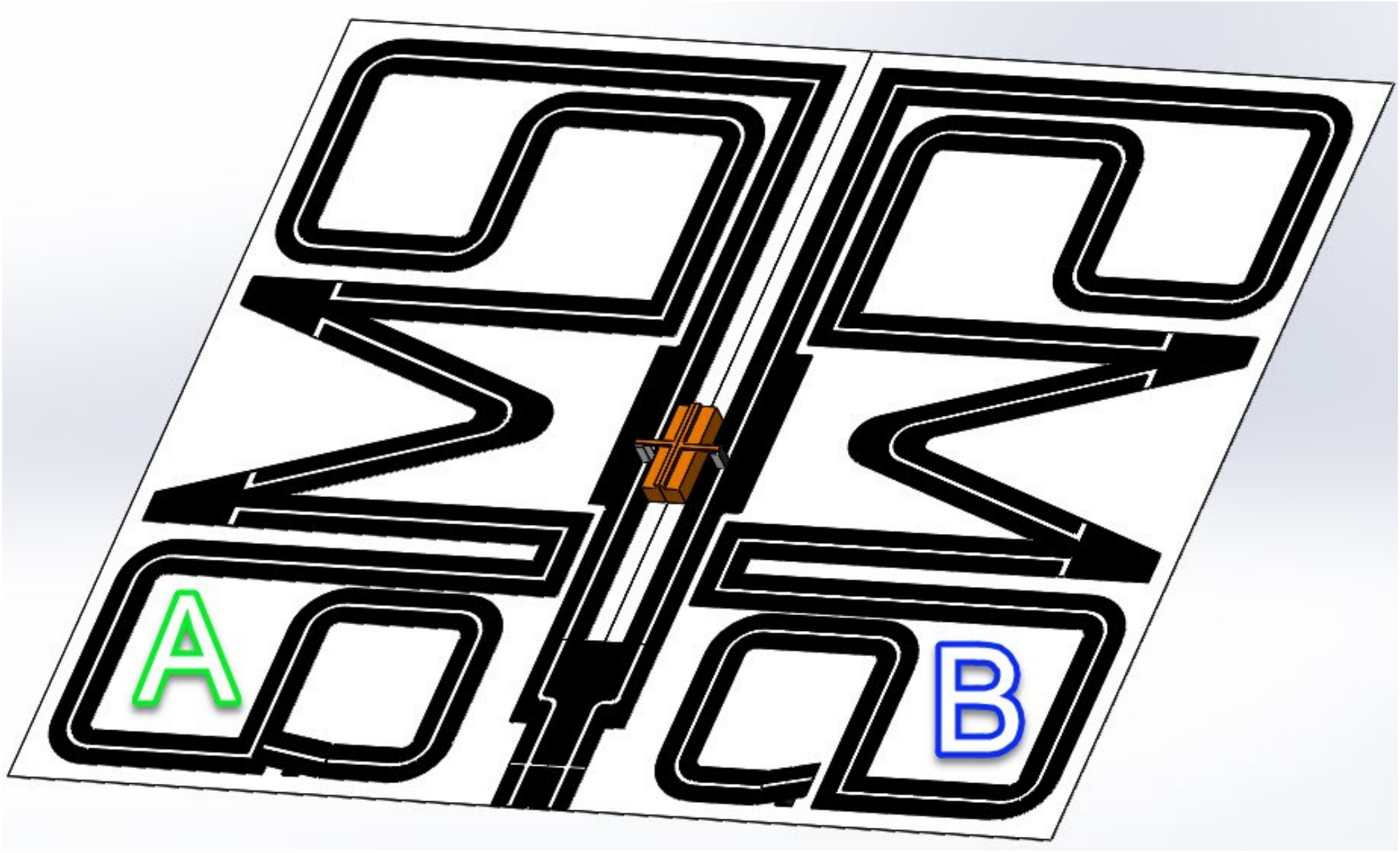
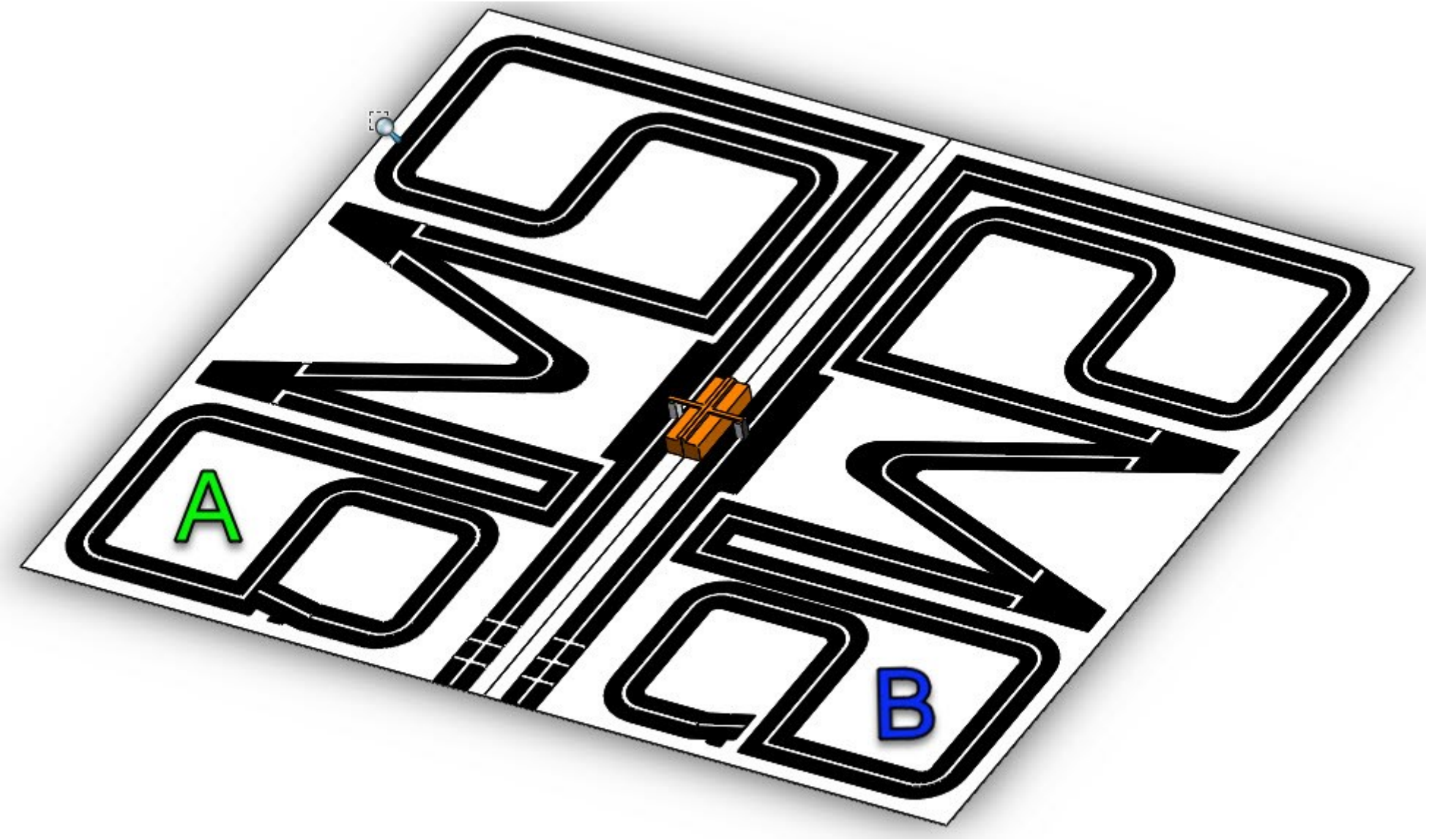
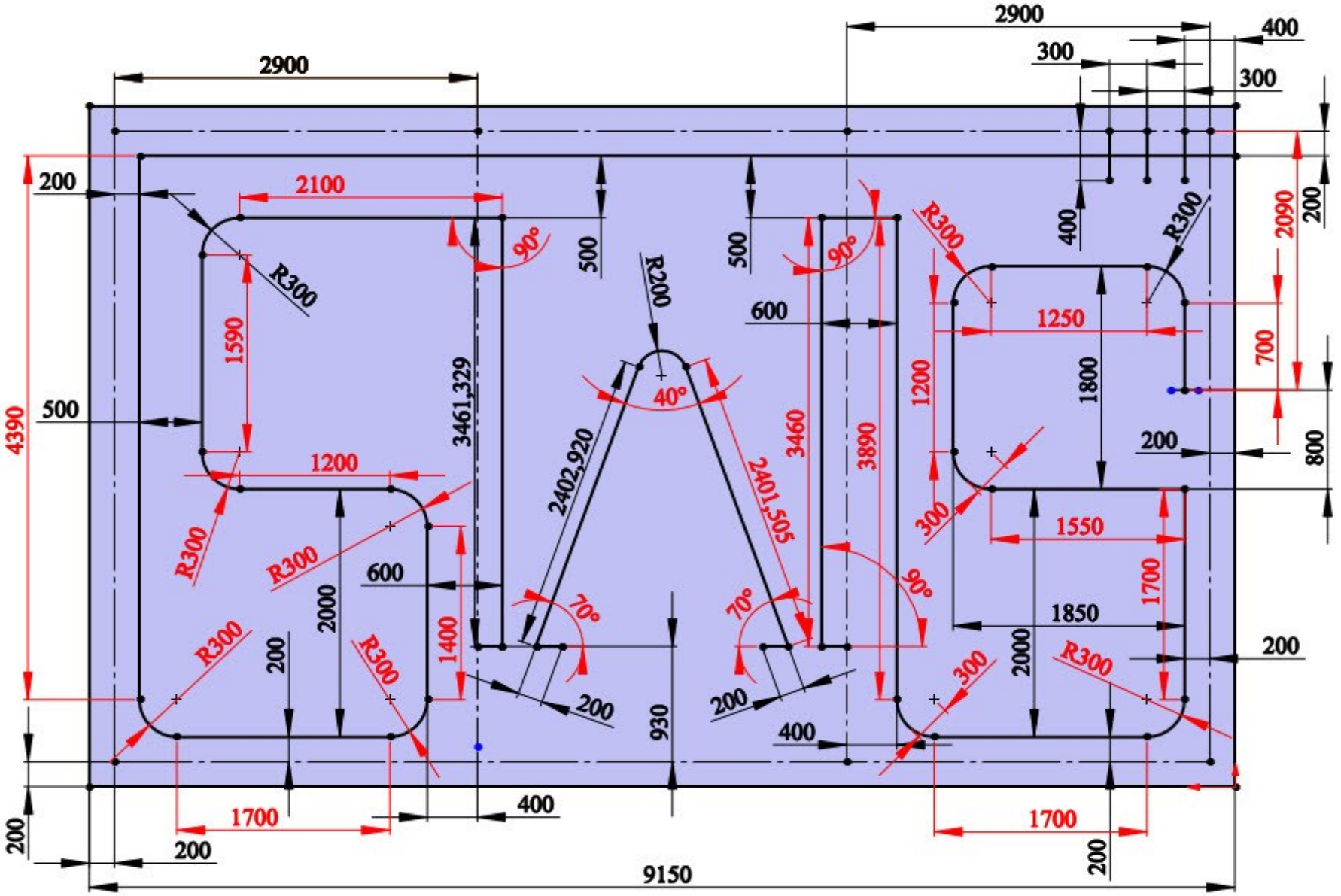
FINAL COURSE 3D VIEW



ELIMINATION COURSE 3D VIEW





Elimination Course dimensions