14 ROBOCON
International Design Contest

The Great Harvest:
Reap what you sow

Rabat, July 14 ~ 26, 2014
Morocco

Content

Introduction

University Mohammed V – Agdal, throug its three organizing institutions : High School of Technology – Salé, Mohammadia School of Engineering and Science Faculty are happy to be the host of IDC – Robocon 2014. This document contains the rules and regulation of the contest.

Context

Morocco is an African country in the border of Europe where modernity and tradition coexist. Rich in ancestral culture and tourism heritage, morocco is known by its sun-drenched oranges and its citrus. Agriculture plays a vital role in the country economy.

Our adventure takes place in the fertile plains of Morocco, where fruits are collected, sorted and shipped to final customer.

Objective of the contest

The main goal of this contest is to collect as many fruits as possible from trees and to sort them into the appropriate containers. The harvesting area (where the fruits are) and sorting area (where the containers are) are separated by a river.

The mission of each team is to design and build **three robots**:

- A **"Harvester Robot"** (RR): This robot will harvest the fruits in the field and put them into a basket.
- A **"Sorter Robot"** (RT): This robot will put each fruit in the appropriate container once the fruits are transported to the sorting area.
- A **"Bridge Robot"** (RP): This robot is the bridge (over the river) that will link the harvesting and the sorting areas.

The transporting of fruits is guaranteed by a "shuttle robot" already build and ready to be used.

So can you harvest all the fruits?

Game field and Objects

The field

1) The contest field is composed of two symmetrical zones. Which allow two teams to play at the same time. The two zones are separated by a "big bridge" that links them.

   Each zone contains 3 areas:

   - A harvesting area: containing 9 trees. The black thick black line is the route taken by the shuttle robot.

   - A sorting area: containing 3 containers; one container for each type of fruit.

   - A river: that separates the two areas.

2) The big bridge gives the competing team's access to both zones.

3) The detailed dimensions of the field are given in figure 1, 2 and 3.

4) The field contains two zones: the harvesting zone and the sorting zone.

5) The harvesting zone: where the Harvest robot can move freely.

6) The sorting zone: where the sorting robot can move freely.

   This information is presented in figure 4.

7) The harvest robot and sorting robot are not allowed to leave or touch the other zone.

Trees and fruits

The harvesting area has three kinds of trees:

- Five *Orange* trees: their access is the easier. With a height between 150 and 300 mm, each tree has at least **6 oranges and a maximum of 10**.

- Three *Lemon* trees: placed behind orange trees, their access is a little bit more complicated. With a height between 200 and 350 mm, each tree has **at least 6 lemons and a maximum of 10**.

- One *Date palm*: Placed in the board corner, this tree is the taller and the most difficult to reach. Its height is between 250 and 400 mm **and has 4 dates**.

The detailed dimensions of trees and fruits (and their position) are to be measured directly from the contest field.

Each zone of the field contains two more objects:

- The first is called "credit card fruit" destined to be put in the competing team's container. The position of "the credit card fruit" is specified in the figure 4.

- The second is a flag which is destined to be placed in the team's flag carrier.

Contest and scoring

Scoring

1) The immediate way of gaining points is to harvest a fruit and to put it in the appropriate container. The gained points are less if the fruit is put in the wrong container. The corresponding points are given in the following table.

Fruit	The right container	Another container
Orange	6	4
Lemon	8	5
Date	12	8

2) **Bonus 01:** During a round, if a team manages to put the "credit card fruit" in the competing team's container it will gain 50% of the points earned from that container. This action can be done only once during a round.

3) **Bonus 02:** During a round, if a team manages to put its flag in the right position (flag carrier) it will boost its final score by 50 points. This action can be done only once during a round.

4) **Bonus 03:** If a team uses solar cells as the only energy source for their Bridge robot it will gain 100 points.

Timing and Winning

1) The contest consists of qualifying rounds and a final tournament.

2) The qualifying rounds will take place on Friday 25th of July. Each team will play four rounds. There will be four teams to play in the final tournament. The qualifying teams are those with the biggest scores.

3) The final tournament will be on the Saturday 26th of July. Each team will play four rounds. The winning team is the one with the biggest score.

4) The qualifying round is 240 seconds, and tournament rounds are 360 seconds.

5) If a result is a tie during qualification or tournament a timed mission to be accomplished will be held to break the tie.

Rules and regulations

General rules

1) These rules are intended to encourage engineering learning.

2) The IDC referees and staff give the final interpretation of any ambiguous rule or new situation not specified in this document.

Round progress

1) The starting points of the three robots are specified in figure 2.

2) At startup, the Bridge robot is attached and has to be freed by any of the two other robots. At the end of its route, it has to deploy the bridge to link the harvesting area to the sorting area.

3) The Harvesting robot has to be remote-controlled. He has to harvest the fruits and may put them in the Shuttle robot.

4) The Shuttle robot wait 30 seconds at position 1 then go to position 2, unload its charge in the sorting area. The shuttle robot will start moving only when the Bridge is deployed. Once the carried fruits are unloaded the shuttle robot will go back to the waiting point (position 1). If the bridge is not deployed the Shuttle robot will go back to position 1 and wait 30 more seconds.

5) It a team doesn't manage to deploy its own bridge after 120 seconds, the IDC referees will put a bridge for that team.

6) The Sorter robot has to be remote-controlled. Its first function is to put each fruit in the corresponding container.

7) Either the sorter robot or the Harvesting robot is allowed to manipulate the "flag" or the "credit card fruit" mentioned in "Scoring" section.

Control

1) Team members must control their own machines. Two team members at a maximum can be actively involved in manipulating the controls.

2) All control must be accomplished without contacting the robot.

3) Control may be achieved via wireless device supplied by the referees and IDC staff.

4) A contestant may not deliberately interfere with the remote control of the opposing player.

5) Robot drivers must wear safety glasses when in the vicinity of the table. Some prescription glasses are acceptable.

Robot configuration

Materials: *Harvester*, *Bridge* and *Sorter* robot have to be made only using the equipment provided in the contest kit. In addition of that, it's allowed to use the following:

- o Bolts, nuts, washers and adhesives available in the shop (but not as structural elements)
- o Vinyl tape used as electrical insulation
- o Grease or lubricant
- o Welds to connect wires
- o Other materials with amount not exceeding 2000 credits.
- o Each team has initially 2000 credits that can be used to buy technical ideas.

Each components or material other than the ones given in the kit must be authorized by the referees.

Size and weight
Let's consider the following notations:
- *Harvester* robot dimension are **: L_R, l_R, h_R**
- *Bridge robot* dimension are : **L_P, l_P, h_P**
- *Sorter* robot dimension are : **L_T, l_T, h_T**

The robots size has to follow:
- $L_R + L_P + L_T$ <= 1000 mm
- $l_R + l_P + l_T$ <= 750 mm
- $h_R + h_P + h_T$ <= 800 mm

The total weight of these robots mustn't exceed 10 kg.

Fabrication
You can use machines in the machine shop set-up for the contest (lathes, band saws…) only in the presence of a technical adviser who will show you how to use them.

Set-up for match
Your robots may be reconfigured between rounds if needed.

<u>Sporting conduct</u>

1) Damaging, touching **and intentionally blocking** the opponent's robot is not allowed. if it does happen the IDC referees decide whether if it's intentional or not.
2) Damaging the contest table and or control equipment is strictly forbidden.
3) Contestants and spectators (i.e. any human beings) may not directly affect the motion of the machines or anything else on the contest field.

General questions and contact

General questions may be asked of all participating faculty, graduate students, undergrad assistants, and staff of IDC2014. However, all officially sanctioned rule interpretations will be made by the referees. The key rulings will be discussed every morning at the morning meeting. The questions and answers will also be archived at the IDC Robocon 2014 web site (http://robocon-2014.um5a.ac.ma/).

Principal contacts:

Ing. Ms. Dr. Mohamed Elamine AIT ALI (aitali@emi.ac.ma)

Professor Mourad GHARBI (gharbi@um5a.ac.ma)

Field figures and technical information

A

Credit Card fruit' initial position

Flag' initial position

Harvester robot's allowed zone

Flag finale position
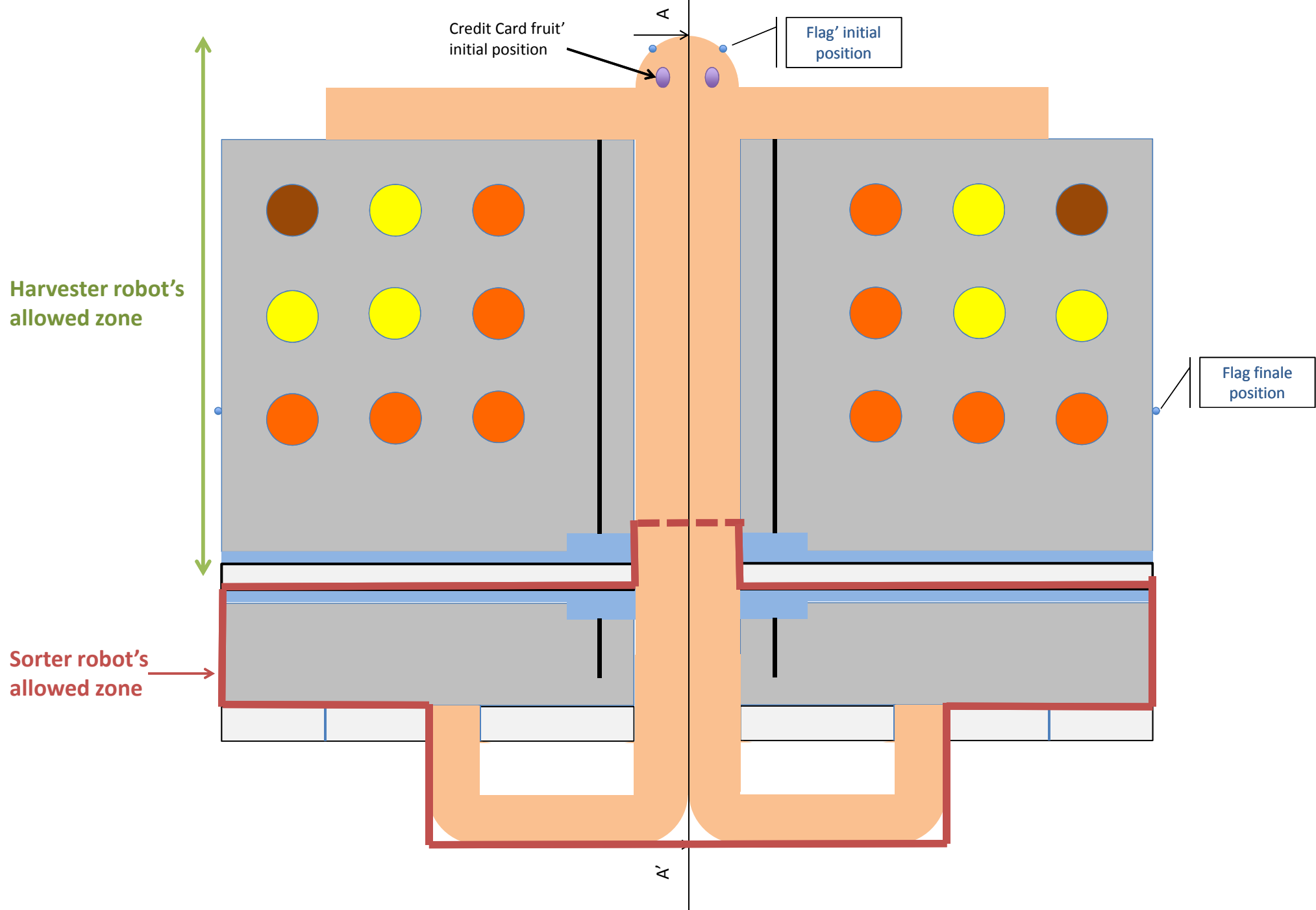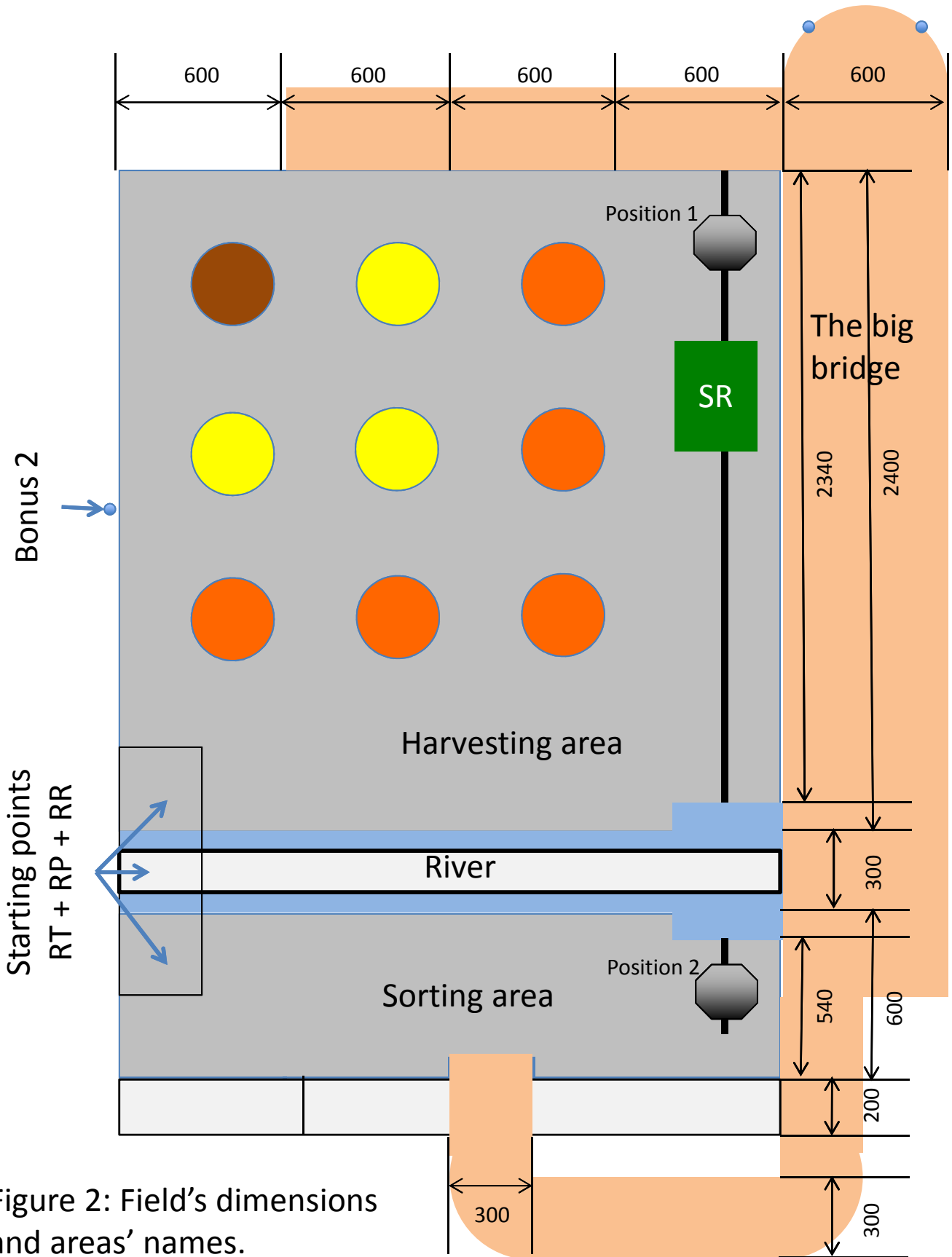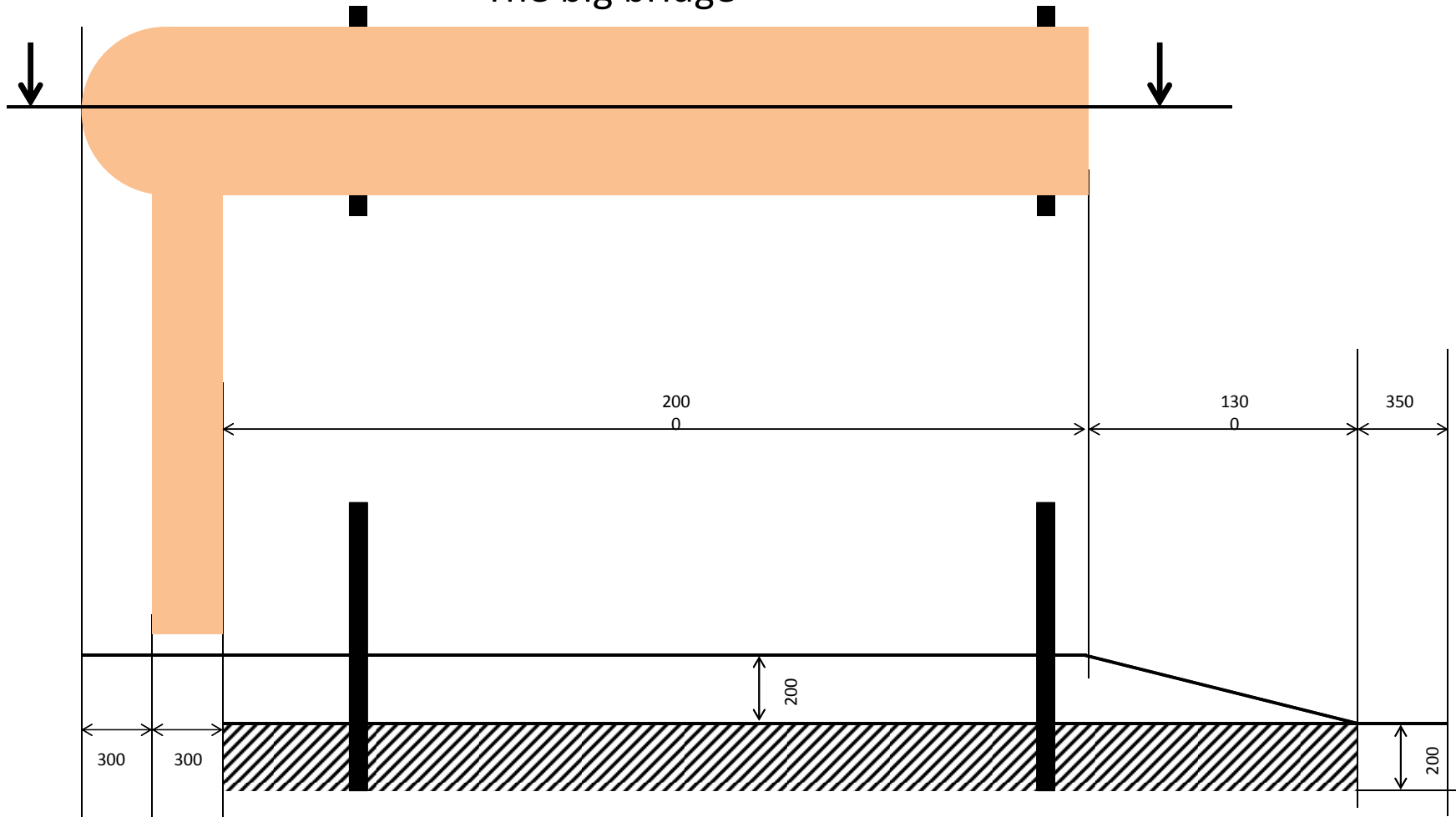
Sorter robot's allowed zone

A'

Figure 1 : View of the contest field.

Figure 2: Field's dimensions and areas' names.

The big bridge

2000

1300

350

300

300

200

200

The big Bridge

2000

1300

350

200

200

300

300

Credit Card fruit' initial position

Flag' initial position

A

Harvester robot's allowed zone
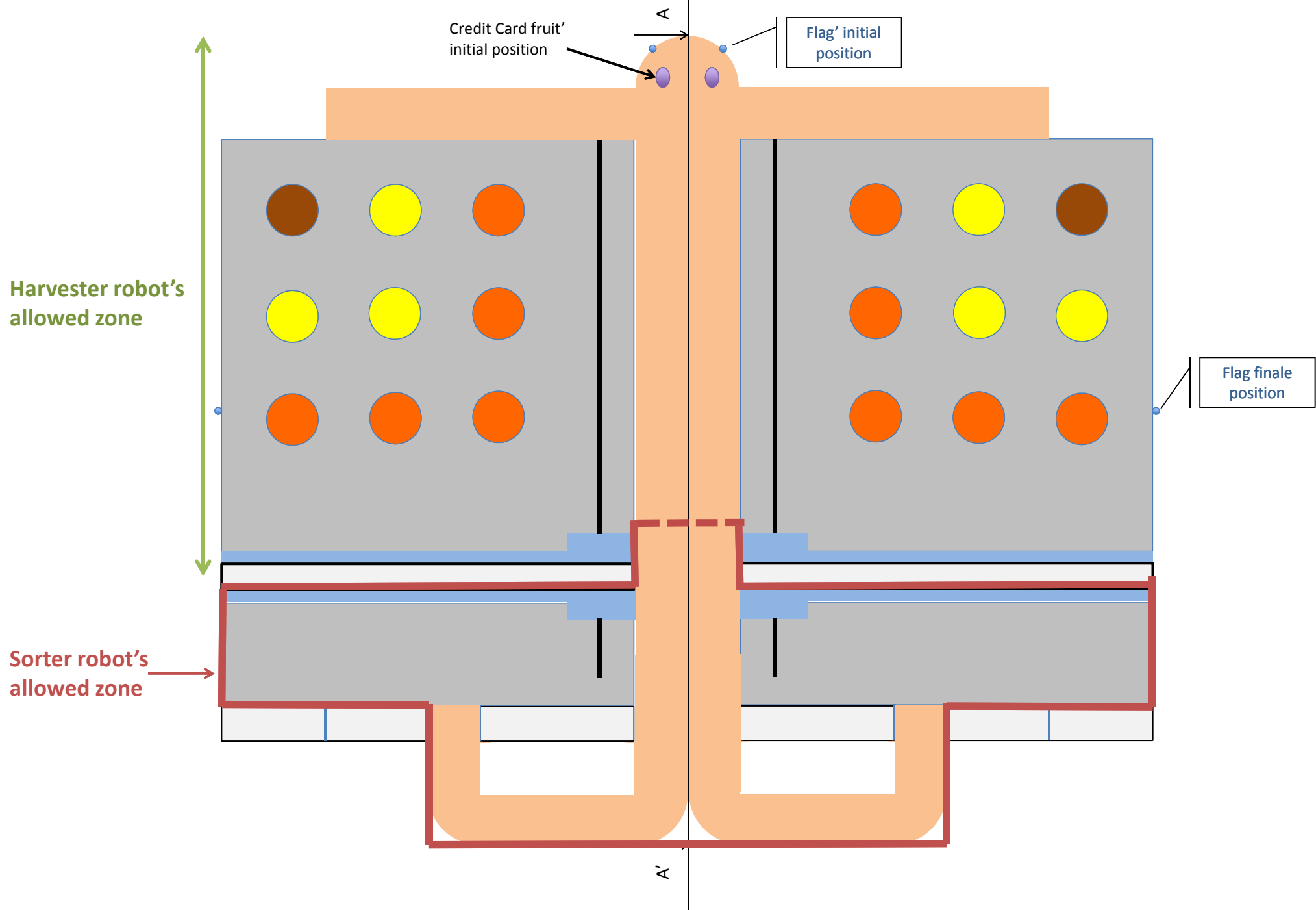
Flag finale position

Sorter robot's allowed zone

A'
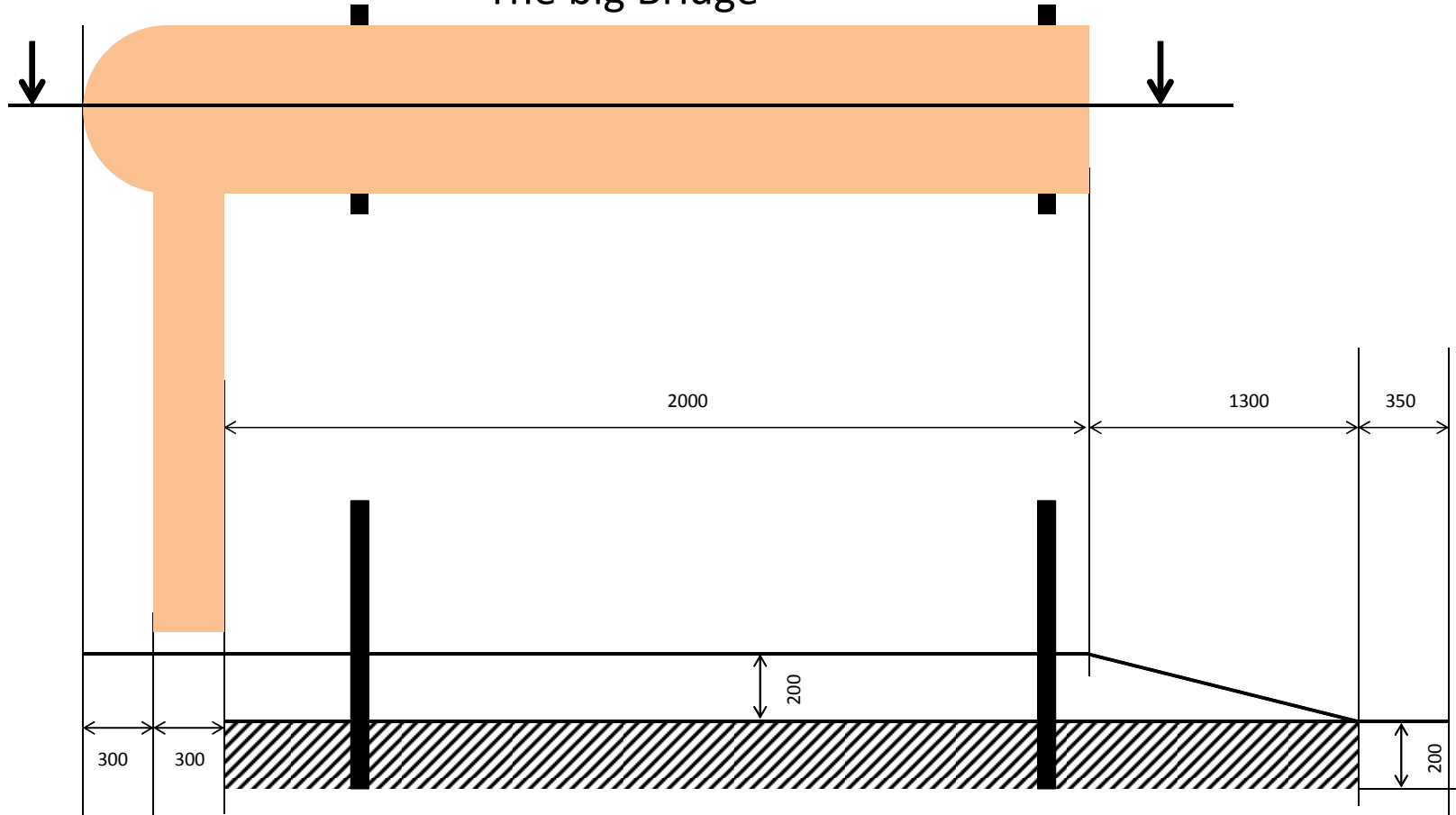
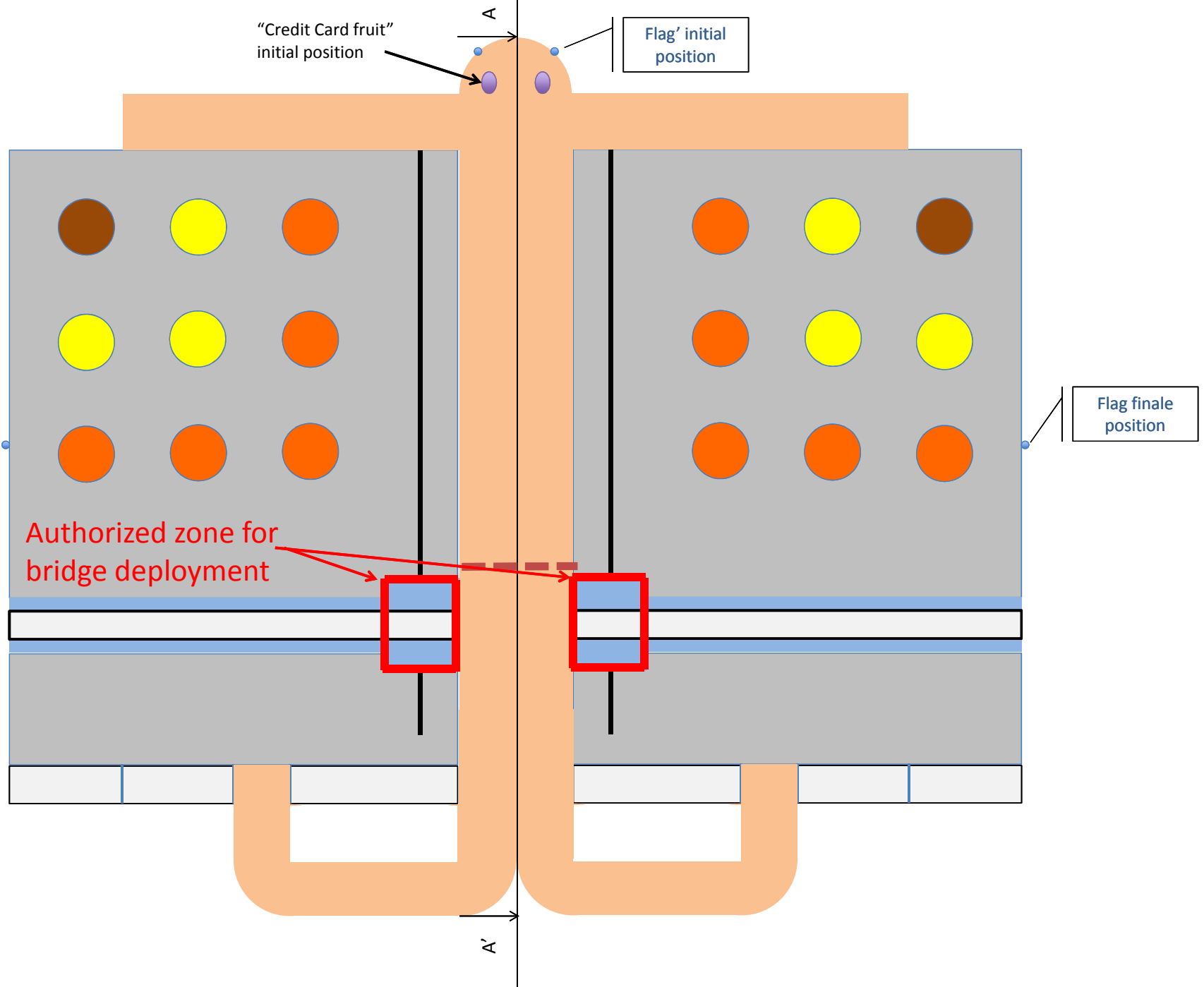Figure 4 : Zones allowed for the Harvest robot and Sorter robot.

Figure 5 : Position of the authorized zone for bridge deployement.