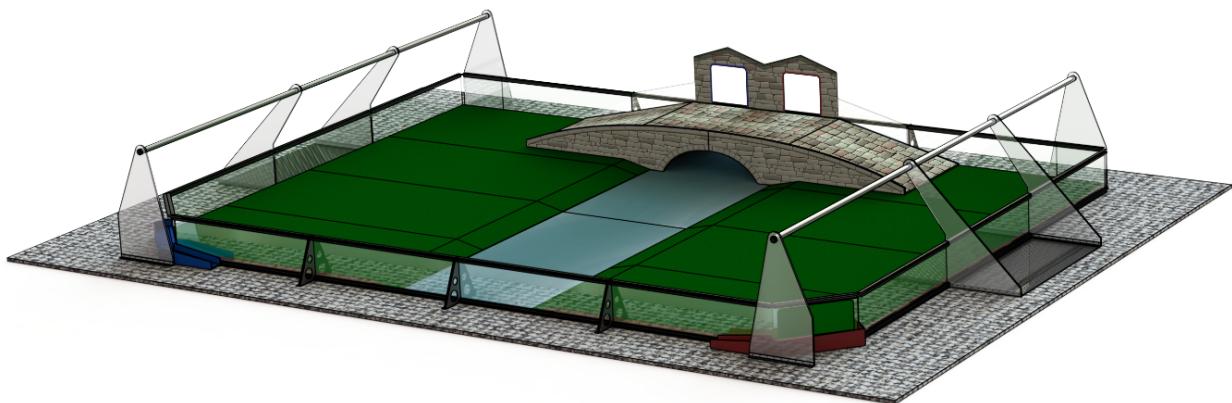




# H<sub>2</sub>O FLOW

## 2017 FIRST Global Challenge Field Build Guide



## REVISION HISTORY

Rev.	Date	Description
1.0	3/22/17	Initial Release

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## PART 0: Introduction

This is the H2O Field Build Guide. This guide is intended to provide field technical specifications and recommendations for building practice field components for teams to test their robots on in preparation for the competition.

The practice field build instructions are designed to be built from plywood, with basic shop tools.

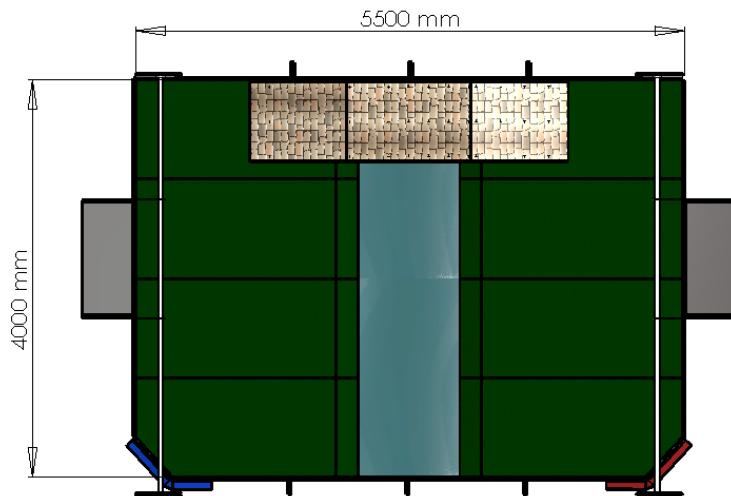
**However, for a simplified version of the key field components that can be built out of very simple items and still be used for representative robot testing, please refer to: PART 6: Basic Field Elements.**

**If you simulate the four key items in PART 6, you will be able to recreate fair representations of the most important parts of the field at no, or little, cost.**

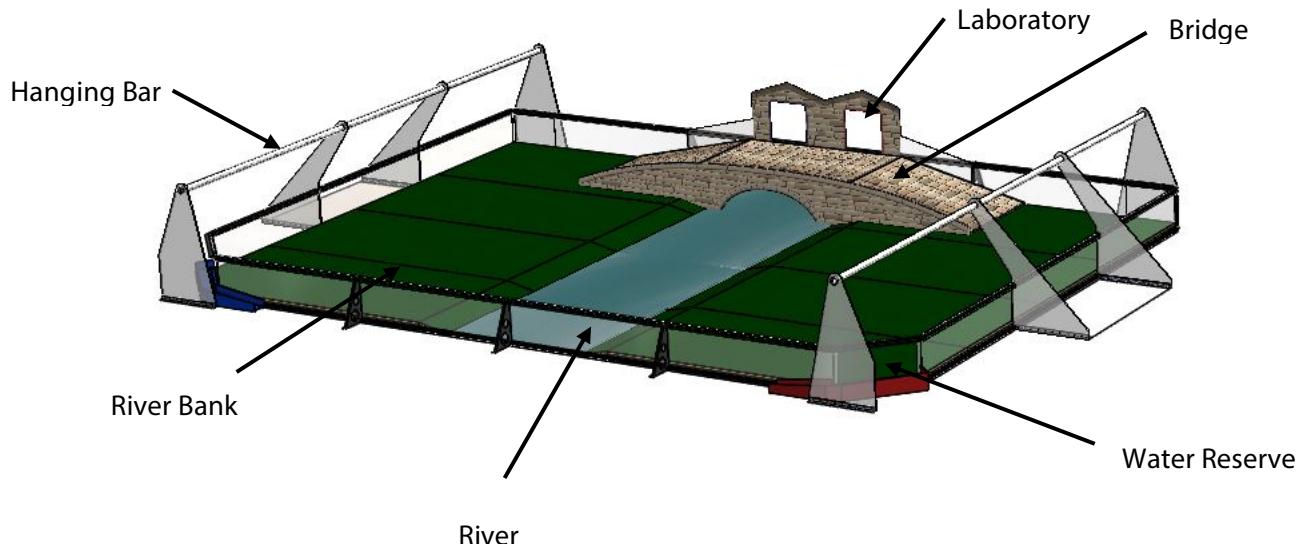
For any questions about field design, please reach out the [GameQuestions@first.global](mailto:GameQuestions@first.global) for assistance.

## PART 1: General Field Layout

- H2O Flow is played on a 4 meter by 5.5-meter field.

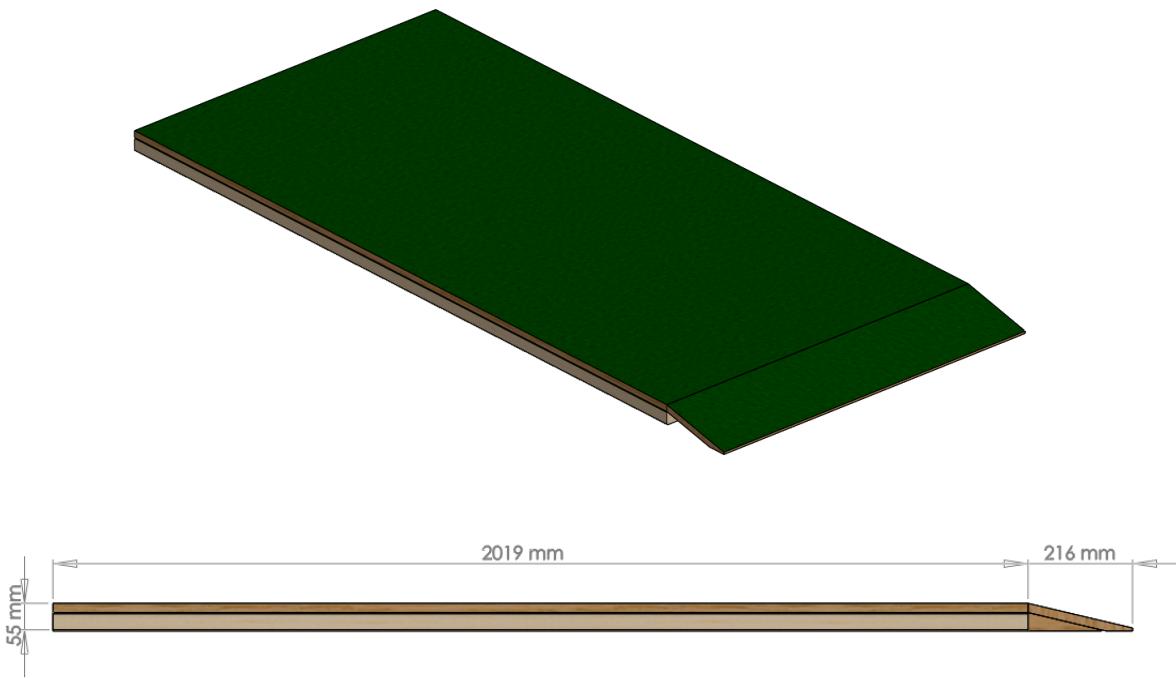


- In the center of the field, is the River, a 4,000mm-long by 1,000mm wide section comprised of a flat polycarbonate panel covered in a decorative vinyl graphic.
- Extending out from the River are the River Banks, which are 4,000mm-long by 2,000mm-wide platforms covered in green carpet. It is raised from the River by approximately 571mm. There are also 250mm long ramps at a 13-degree angle leading from the River to the top surface of the River Banks.
- At each end of the field is a Climbing Bar, which is a 42mm diameter, 750mm high (measured to the top of the bar) aluminum pipe that spans the width of the field. It is supported by polycarbonate uprights.
- Underneath each Climbing Bar in the front corners of the field, are 200mm x 500mm openings along the top surface of the River Banks called Water Reserve Goals.
- Spanning the back end of the River Banks and the River, is the Bridge. The Bridge is comprised of a 300mm high, 1250mm long, by 800mm wide panel that is approximately parallel to the floor, with two 1000mm long ramps at a 14-degree angles leading from the top surfaces of the River Banks.
- At the top of the Bridge, against the back of the field, there are two 300mm by 300mm square openings called Laboratory Goals.



## PART 2: River Banks

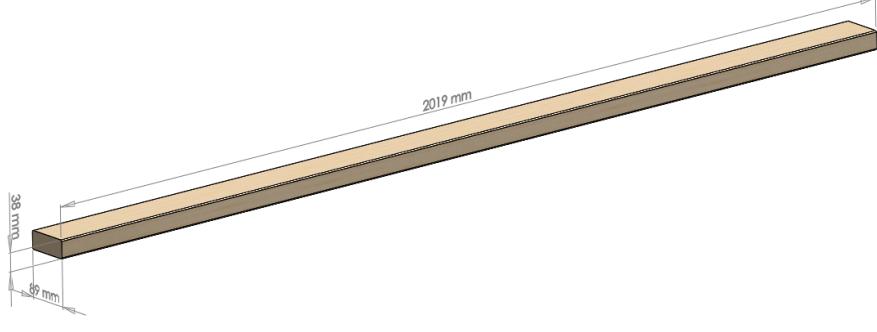
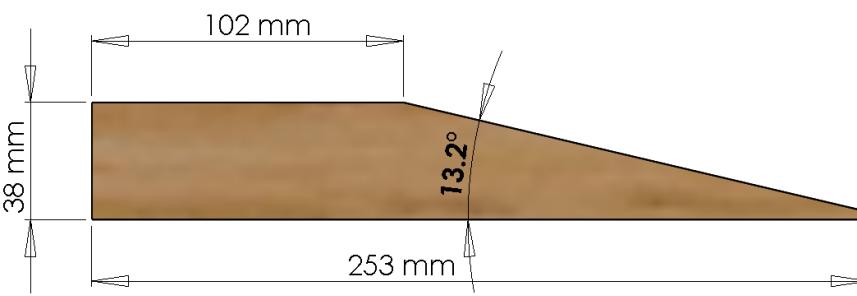
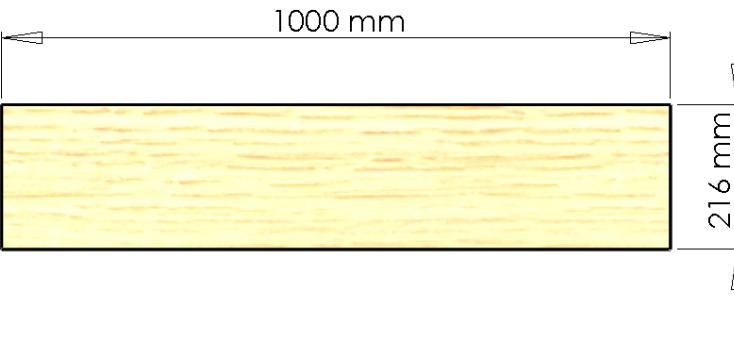
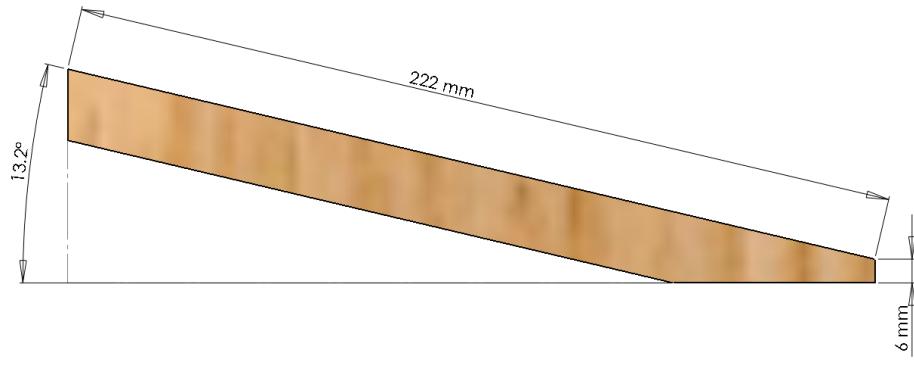
On the competition field, the River Bank consists of 8 plywood platform sections covered in short pile carpet.



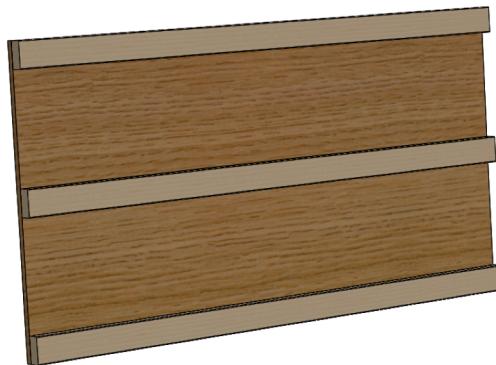
The competition River Bank can be approximated using the dimensions above. The top of the River Bank is raised 55mm from the River. On the competition field, 20mm plywood is used, but any stiff material can be used for a practice field.

A more accurate River Bank can be replicated using the methods below.

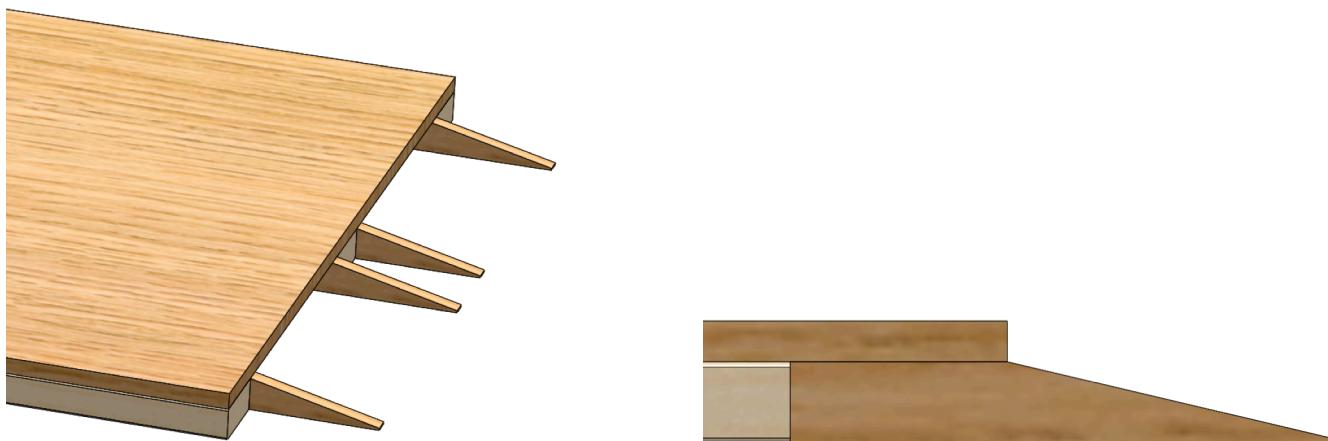
Component	QTY	Dimensions
Main Platform	1	<p>2019 mm</p> <p>1000 mm</p>

<b>Support</b>	3	
<b>Angled Rib</b>	4	
<b>Ramp Angle</b>	1	<p>Top View:</p>  <p>Side View:</p>  <p>Note: Side view shows how ramp panel should be trimmed so that it sits flush with the floor and main platform. Leaving a 6mm step prevents the edge from getting damaged or destroyed.</p>

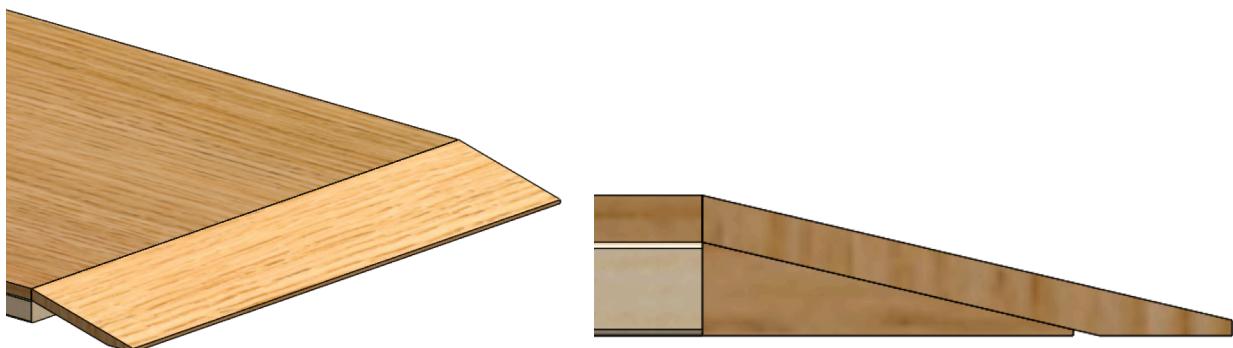
**Step 1:** Secure the Supports to the underside of the Main Platform using wood screws or industrial staples.



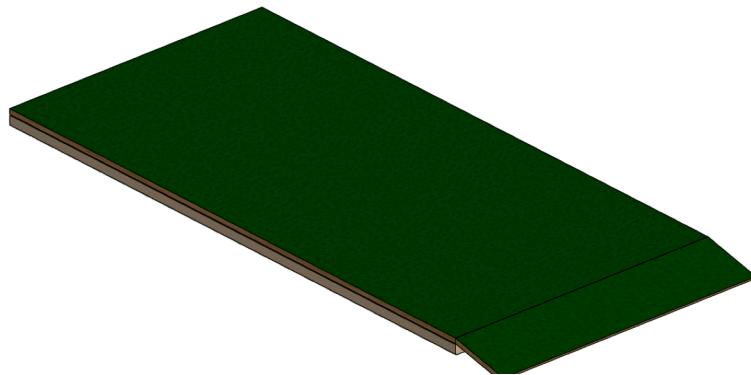
**Step 2:** Secure the Angled Ribs to the Main Platform in the locations below using wood screws or staples. The edge of the platform should be aligned with the edge of the angled portion of the rib.



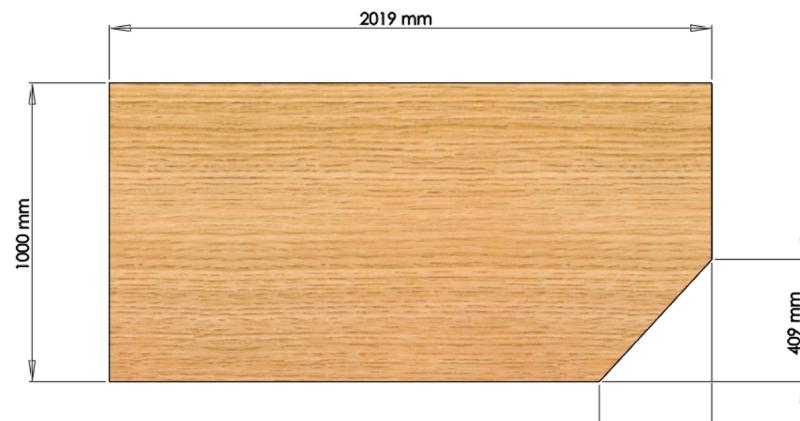
**Step 3:** Secure the Ramp Angle to the Main Platform using wood screws or industrial staples. Ensure panel edges are aligned with minimal gaps and smooth transitions.



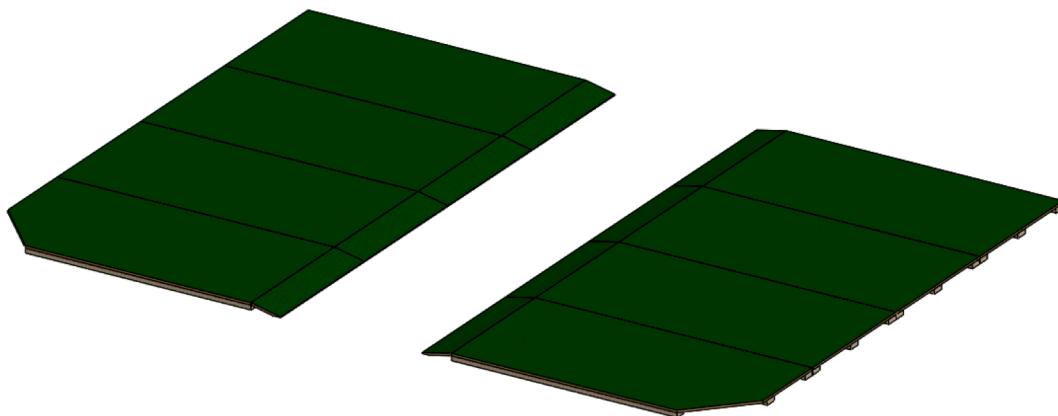
**Step 4:** Cover the River Bank Platform with Tight Pile Carpet to match the competition playing surface. This can be attached with industrial staples to the wood surface.



**Step 5:** Two River Bank Platforms have the corners removed for the Water Reserve Goals. Trim down the Main Platform and the supports as shown. This can be done using a circular saw or other saw. The cutout should be mirrored for the other side of the field.



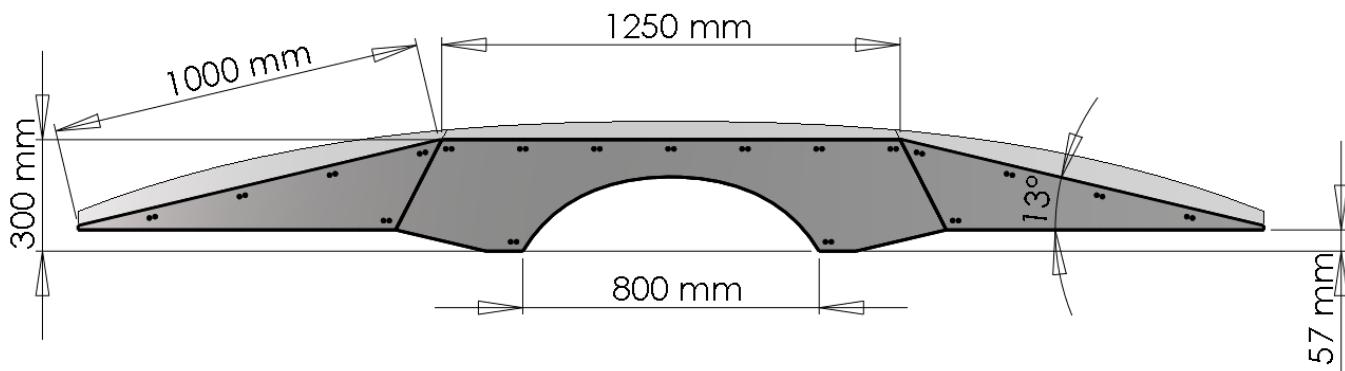
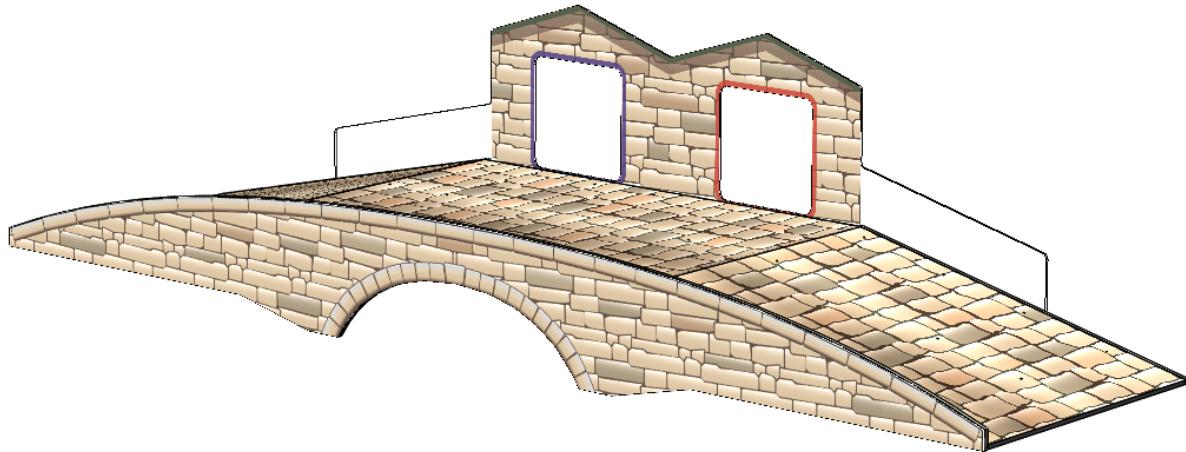
**Step 6:** For the complete playing field, 6 River Bank Platforms and Two Platforms with cutouts are used. Orientation of River Bank Platforms is shown below. The platforms can be placed with no gaps in between and will be held in place at the competition by the perimeter rail.



## PART 3: Bridge

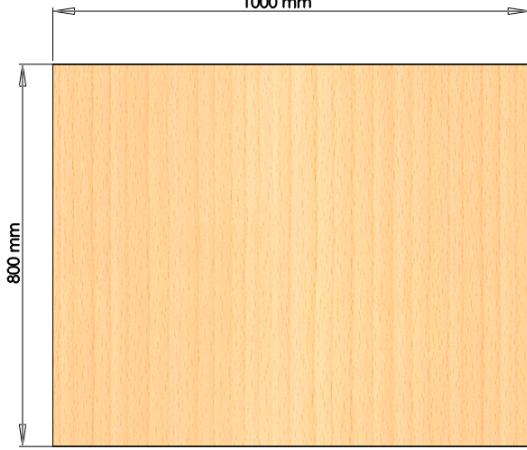
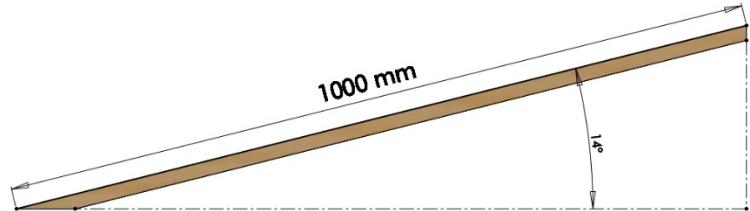
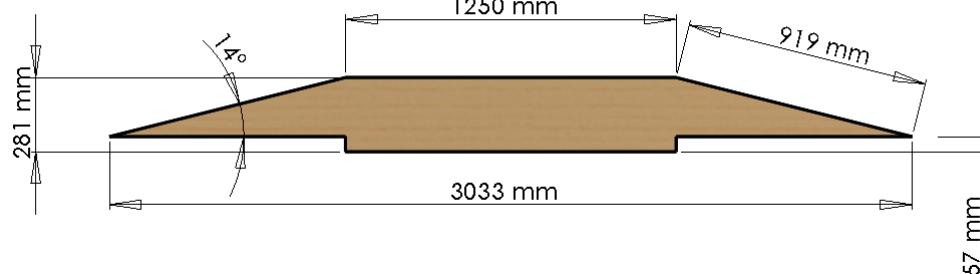
On the competition field, the bridge is made up of rigid structural pieces and covered with a smooth polycarbonate panel surface. The bridge is made up of 3 flat panel ramps with a curved railing edge on the front side and the laboratory on the back side.

**BRIDGE IS DESIGNED FOR LIGHTWEIGHT ROBOTS ONLY. NEVER STAND OR PUT YOUR WEIGHT ON THE BRIDGE!**

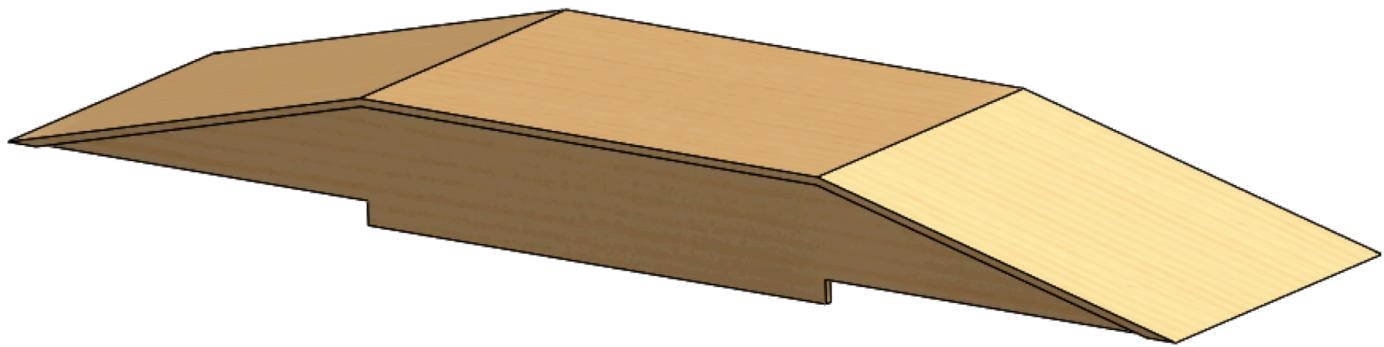


For practice, the bridges can be approximated using any rigid surface with the dimensions above. For a practice bridge closer to the specifications of the competition bridge, follow the guide below.

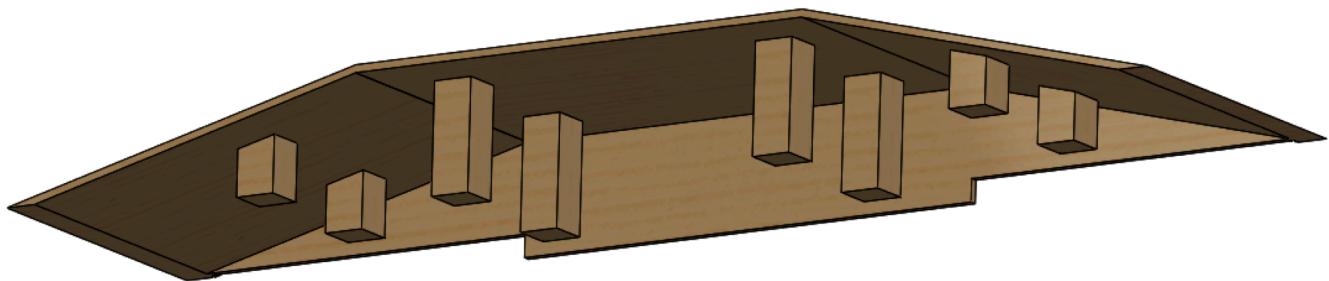
Component	QTY	Dimensions
Bridge Top	1	A diagram showing the dimensions of the bridge top. It is a rectangle with a width of 1250 mm and a depth of 800 mm. The top surface is shaded orange.

<b>Bridge Ramp</b>	2	 <p>Top View</p>  <p>Side View</p> <p>Note: The edges of the bridge ramp panels should be trimmed to allow the ramp to sit flat on the River Bank.</p>
<b>Bridge Panel Support</b>	1	 <p>Note: The panel support can be cut out of one panel, or pieced together from multiple pieces.</p>

**Step 1:** Assemble Bridge Sections together using wood screws or industrial staples. The panel support can be used to hold the panels at the correct angles.



**Step 2:** The Bridge will need to have structures added to the bottom side of the ramp. Items can be stacked underneath the ramp, or additional wood columns can be added to the structure with wood screws or staple as shown.

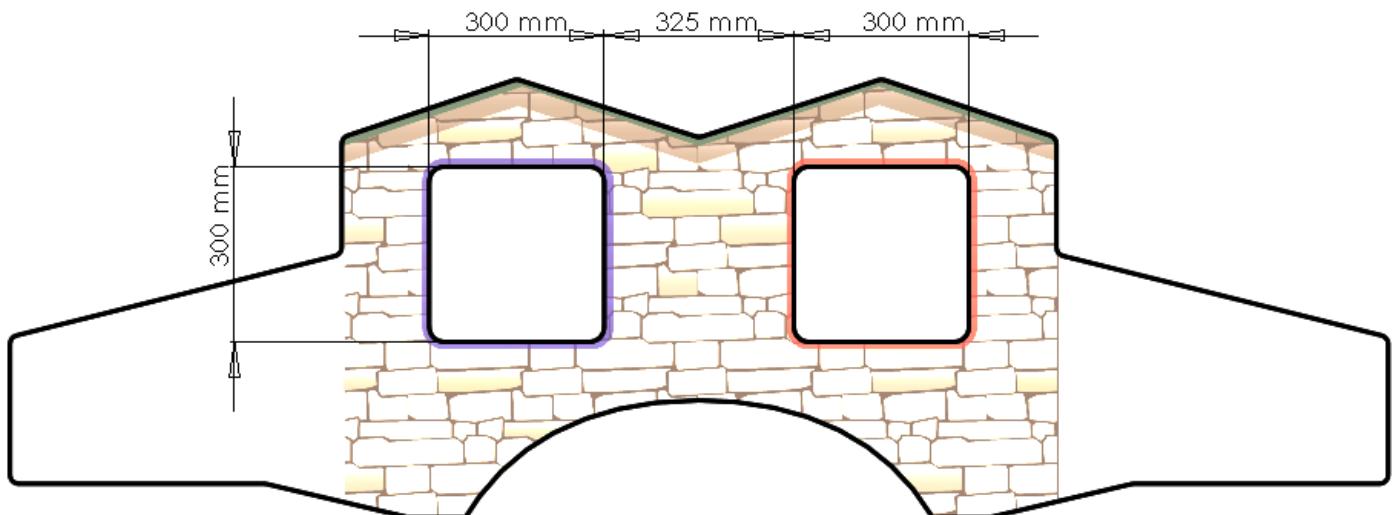


## PART 4: Goals

There are two types of goals on the field: the Laboratory Goals and the Water Reserve Goals.

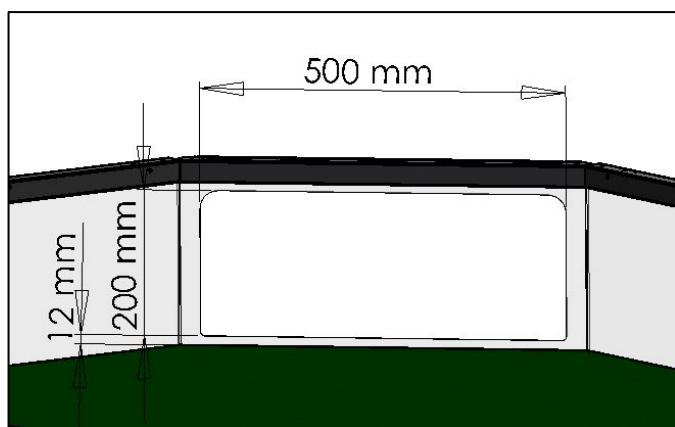
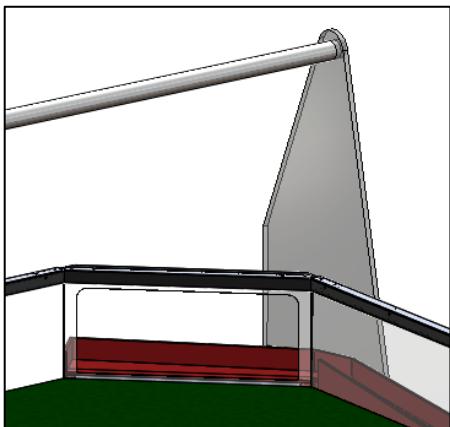
### Laboratory Goal:

The Laboratory Goals are constructed out of a polycarbonate sheet and have the following dimensions. For practice they can be approximated with a hole in any rigid material such as plywood with the following dimensions. The goals are centered on the bridge structure with the bottom of the goal aligned with the top of the bridge. The Laboratory Panel is secured to the bridge with screws on the competition field.



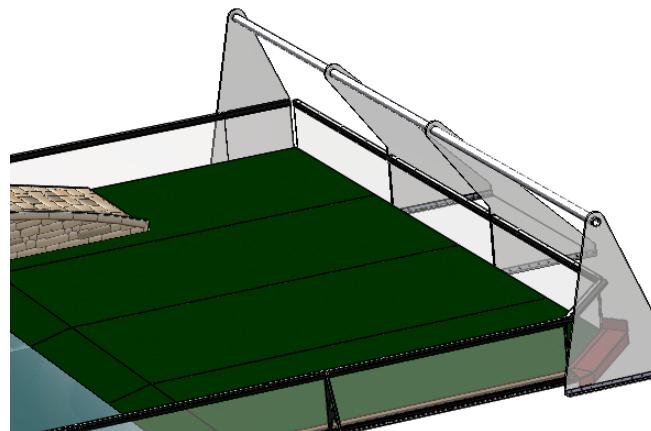
### Water Reserve Goal:

The Water Reserve Goals are holes in the polycarbonate perimeter panel. For practice, they can be approximated with a hole in any rigid material with the following dimensions. The goals are centered on the corner cut out on the River Bank Platforms. The bottom of the goal is 12mm above the top of the River Bank.

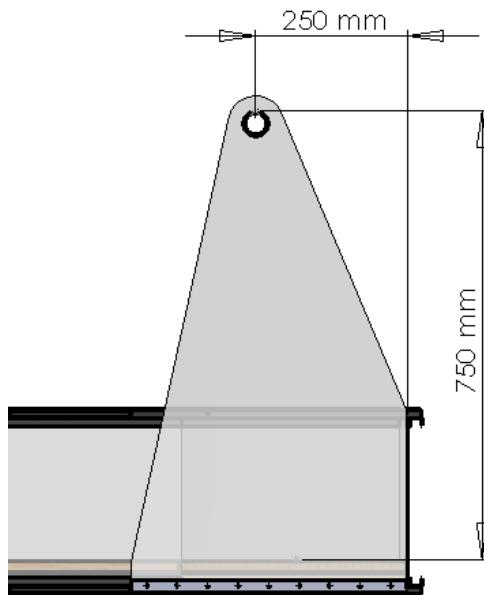


## PART 5: Hanging Bar

On the competition field, the Hanging Bar is a 42mm diameter rigid aluminum tube.



The top of the tube sits 750mm above the top surface of the River Bank and spans across the full width of the field. The Hanging Bar is 250mm away from the edge of the field.



Side View:

For Practice, the Hanging Bar can be approximated by any similarly sized pipe rigidly mounted with the top edge 750mm above the ground.

Please be sure that your Hanging Bar is properly secured before you attempt to hang your robot to prevent possible damage to your kit.

## PART 6: Basic Field Elements for Key Robot Testing

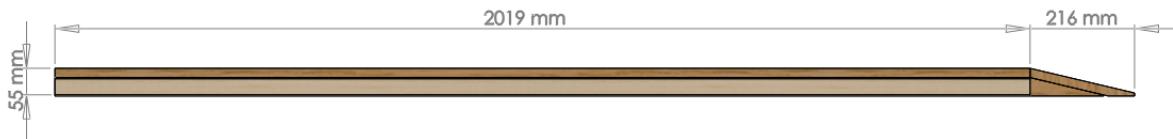
This section describes how participants can use very basic or simple materials to build the four key field components that you may want to test your robot on at no, or little, cost. For example, you may want to test your robot to ensure it can drive up the bridge incline; maneuver a ball into the goals; or hang from a raised bar – as the game permits at the end of the round to earn extra points.

This part of the guide shows what most teams will do to test their robots if they decide to experiment with it as they engineer their robots. And if you decide to wait to test your robot until you arrive at the event, you will have one and one half days of practice rounds at the competition on 15-16 July.

In addition, when testing your robot on the flat and angled surfaces below, it would be best to cover the solid surfaces with an old piece of short fiber carpet if possible for a more realistic simulation.

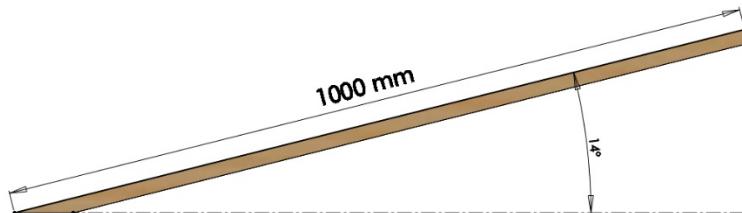
**River Banks:** Constructing a replica of the river bank will likely be the basic test you will want to complete. Constructing A River Bank replica out of any type of flat surface (such as any type of wood) will allow you to ensure that your robot will be able to maneuver across the component of the entire field. To take this test a step further, you can use another piece of wood at a slightly raised angle to simulate your robot driving up from the River to the River Bank. This should not be an issue for any robot.

For the River Bank, a flat surface and an angled edge with the following dimensions can be used. As you can see, the angle from the River Bank will be approximately 13°



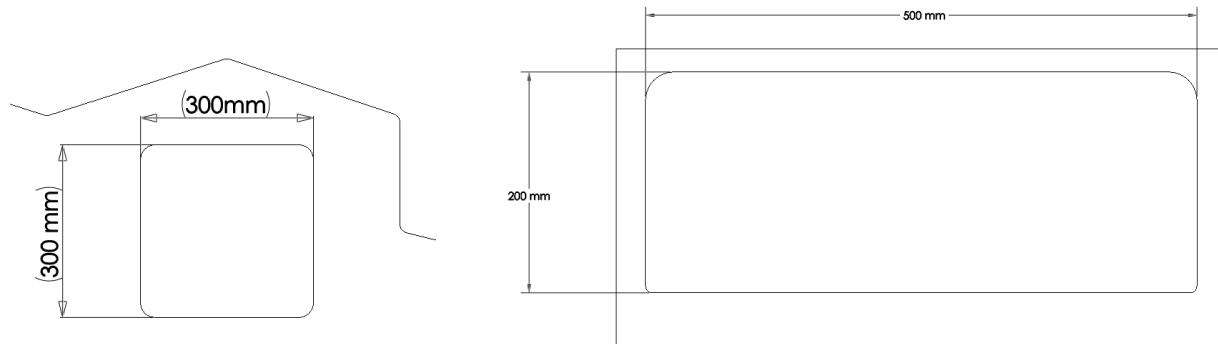
**Bridge:** Simulating the Bridge is also a very simple task. You can use any flat surface that is 1,000mm in length and raised at an angle of 14 degrees. All you need to do to complete this simulation is test your robot's ability to drive up the specified incline on a rigid surface such as a piece of wood.

The Bridge can be approximated using any flat surface with the following dimensions. The angle will be approximately 14°

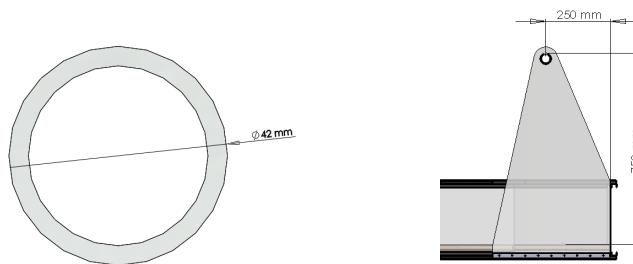


**Goals:** The third key component to test is your robot's ability to succeed in placing game balls into the goal openings (the Laboratory on the bridge and the Water Reserve in the field corners). By cutting holes that are the size of the dimensions shown below, you can test your robot's ability to push game balls into either goal. Depending on how you design your robot, you can even test its ability to throw a game ball into the goals. Any material using these dimensions will be sufficient to test your robot's ability to accomplish this task.

When testing the opening for the Laboratory Goal, you should mark out an area in front of it that is the length and width of the bridge (1,250mm x 800mm) in order to ensure you can sufficiently maneuver while your robot is on the bridge.



**Hanging Bar:** The last component may be the most challenging to replicate and design your robot to accomplish – although both can be readily done. All you need is a round, tube-like piece of material that is roughly 42mm in diameter. If you can hang the bar approximately 750mm above the floor, and you design your robot to reach up to that level, you will be able to readily test your robot's ability to pull itself up and hang in position.



Please be sure that your Hanging Bar is properly secured before you attempt to hang your robot to prevent possible damage to your kit.

**If you can test your robot in some or all of these four areas, you will have tested the key engineering challenges your robot will need to accomplish. If you succeed, you will be more than ready for the 2017 FIRST Global Challenge.**

For any questions about field design, please reach out the [GameQuestions@first.global](mailto:GameQuestions@first.global) for assistance.