Tutorial: Requirements for RoboCup MSL

Good playing conditions are crucial for a well organized competition. Based on past experience we have created this document containing a list of required materials and general tips and tricks on how to build a MSL field that meets the rules of the competition and is robust enough to last for an entire tournament.

Questions can be directed to:
liufei@caa.org.cn (Chair of Organizing Committee)
rc-msl-tc@lists.robocup.org (Technical Committee, TC)
rc-msl-oc@lists.robocup.org (Organizing Committee, OC)

Or to the Exec Committee:
Junhao Xiao, National University of Defense Technology (China)
Seyed Ehsan Marjani Bajestani, Mechatronics Research Laboratory, Qazvin Islamic Azad University (Iran)
Wouter Houtman, Eindhoven University of Technology (The Netherlands)

General info on the RoboCup MSL competition, along with the official rulebook, can be found on this website: https://msl.robocup.org

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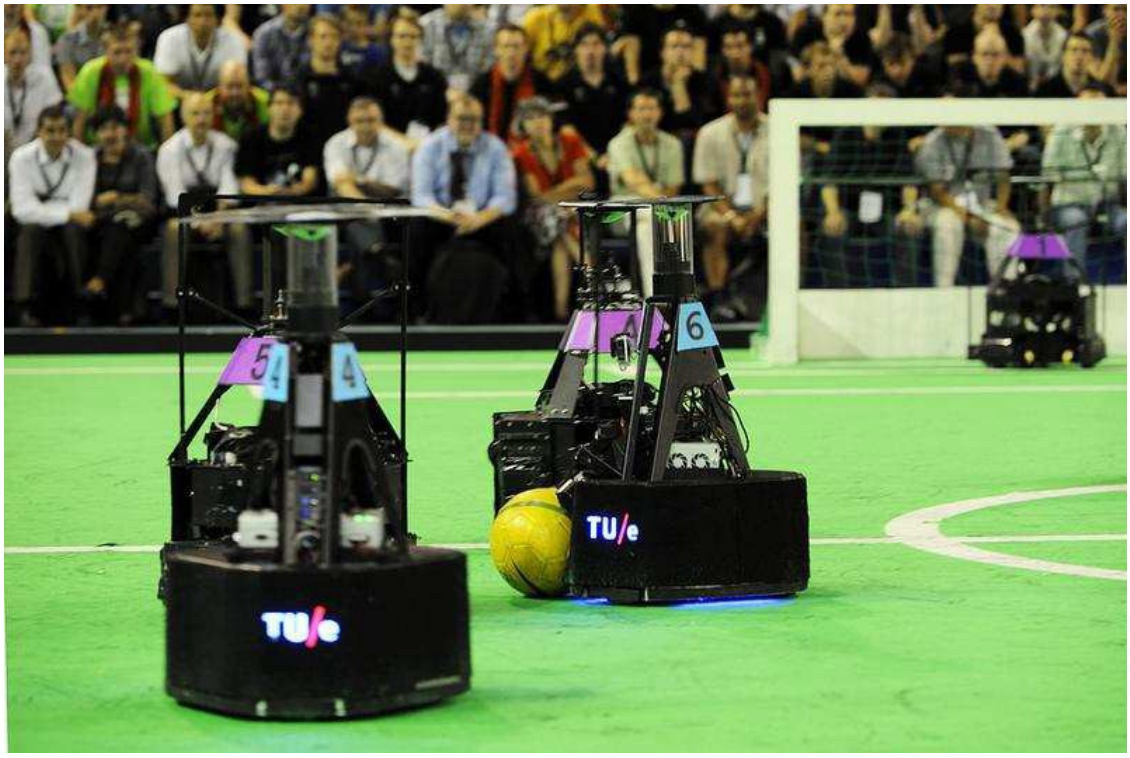
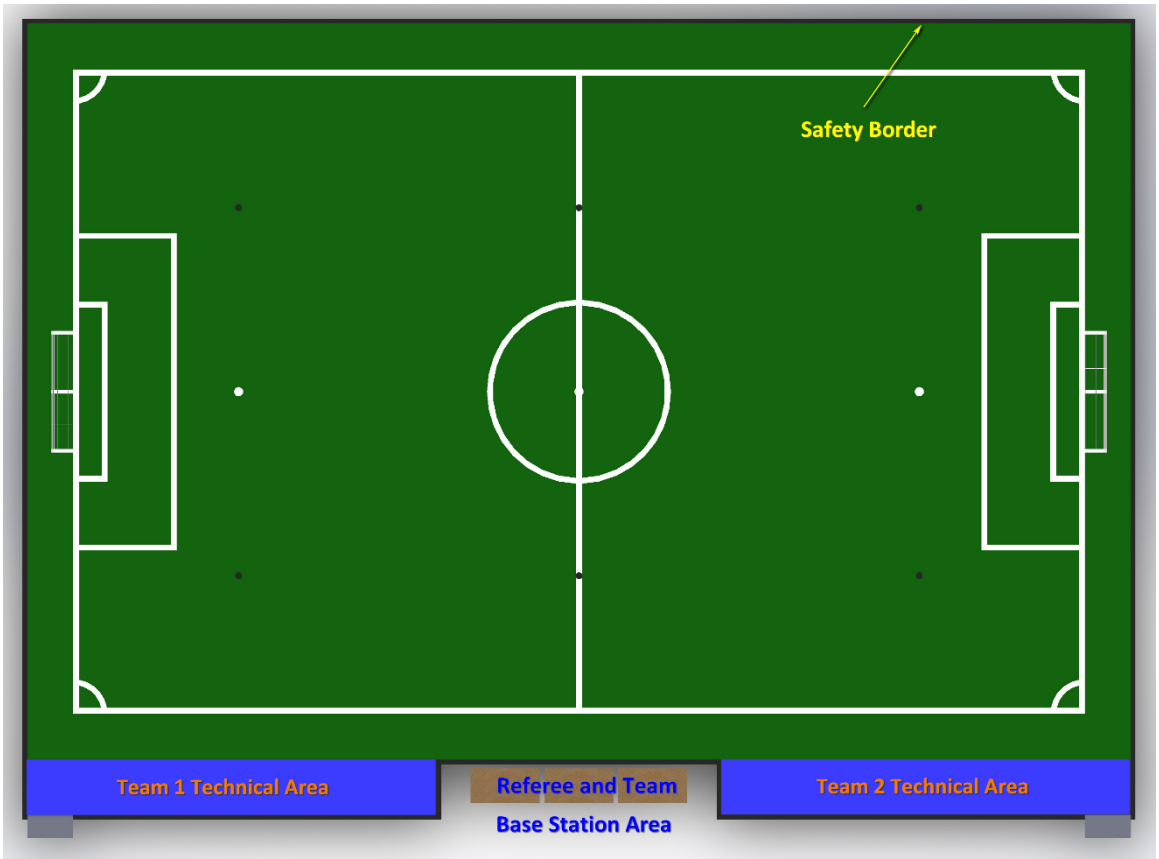


Playing Field Dimensions

Field dimensions are specified in the figure below. The width of each of the field lines is defined as 12.5 cm. The sketch is scaled properly.

Although it probably is clear from the image(at the end of the document (page 17)): White lines are integral part of the field or of any of the areas they contain. Therefore, measurements are to be done from the outer side of any line. The only exception is the mid field line, which must divide the field in two equal- sized areas.

Between the outer lines of the field and the absolute edge of the field, **a green zone with a width of at least 1 meters should be present** (for safety and for the robots to manoeuvre behind the ball during throw-in and corner kick situations). There is a detail dimensions pic and table at the end of the document.

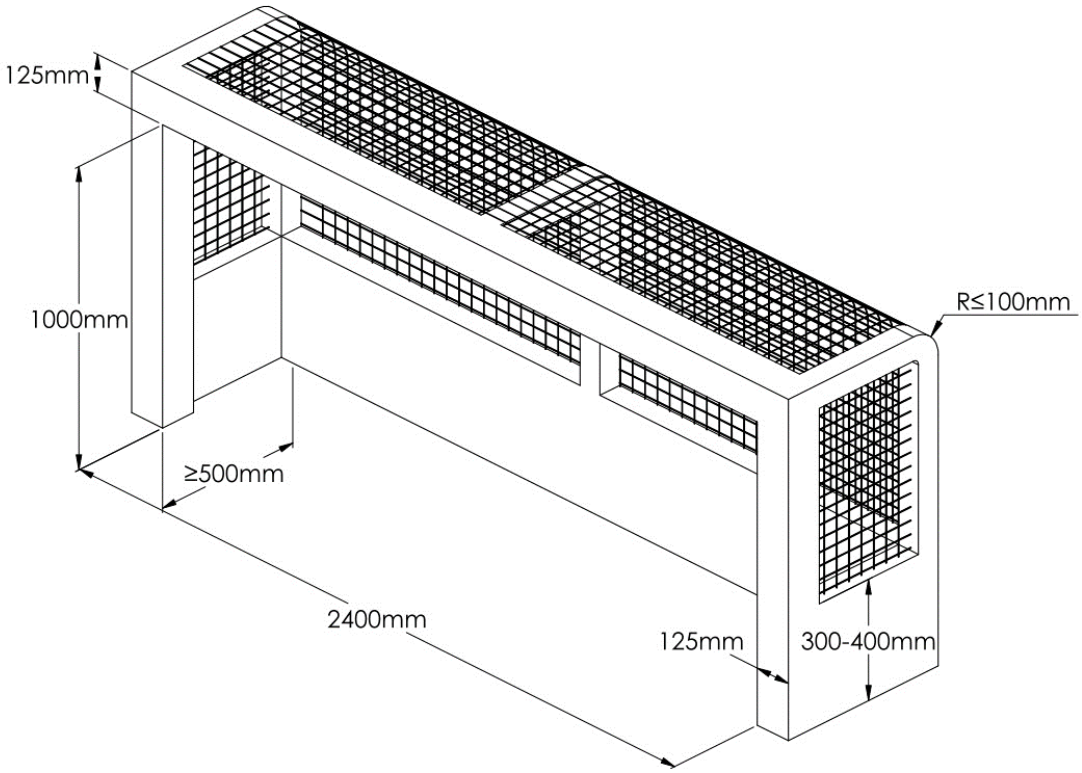


Of the same side of the field where the tables for the Referee Box Computer and Team Base Stations are located, two Team Technical Areas (TTAs) must exist at the exact same level of the remaining field of game. These areas must be at least 1m wide and at least 7m long. No Safety Boundary exists between the green carpet and these areas. Instead, the safety border should run outside the technical areas. The Team Technical Areas must be covered in blue carpet of the same type used for the gaming areas. On the opposite sides of these areas an opening 1m wide in the Safety Boundary must exist, and a low slope ramp must connect this opening to the ground floor level to allow robots to move smoothly into and out of the TTAs. Please find the perspective view of the complete field at the end of the document (page 18).

Goal Dimensions

To avoid direct contact of the net with parts of the robots (wheels, kicking device, etc.), the lower part of the net should be covered over a height between 30 and 40 cm. The entire goal should be painted white.

The goal should be strong enough to handle collisions with robots weighing up to 40 kilograms and strong enough to handle shots with an official FIFA ball of up to ten meters per second. In case the goal is made out of a lightweight material, it should be fixed to the field surface. In order to prevent the keeper getting stuck with the upper parts of the nets, the radius of the arc at the upper-back region of the goal has to be below 100mm.



Constructing a Field

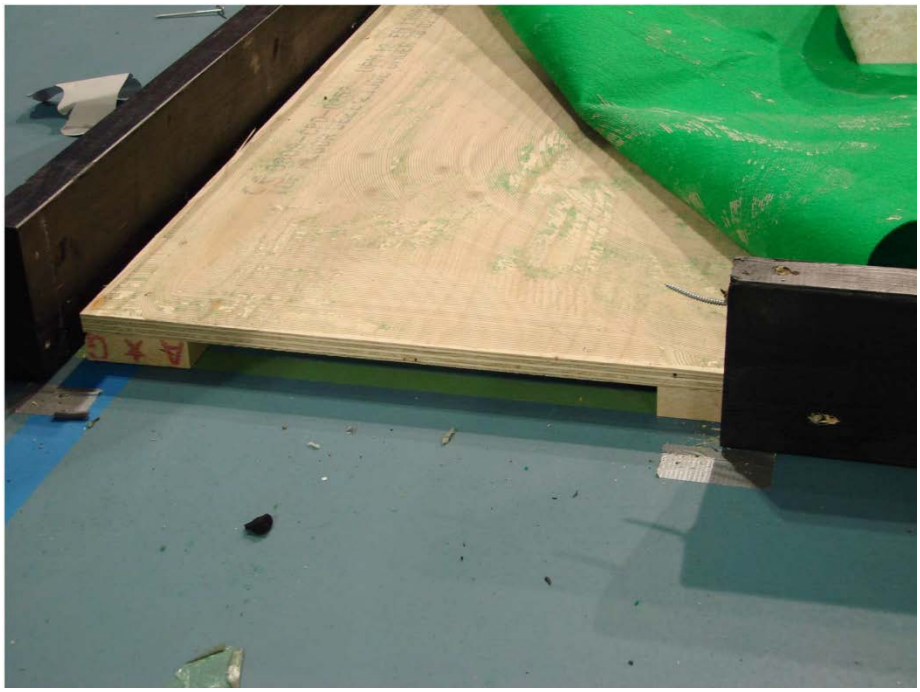
A RoboCup MSL field should be free of bumps and other surface irregularities. It should be covered by a thin green carpet glued to the subfloor. The carpet can be of a felt-like material but needs to be strong enough to stay intact when wheels of the robots are slipping for short periods of time.

The following procedure is highly recommended:

1. Create a wooden subfloor, make sure no irregularities arise at the edges of the wooden plates and no screws or other sharp things are sticking out.

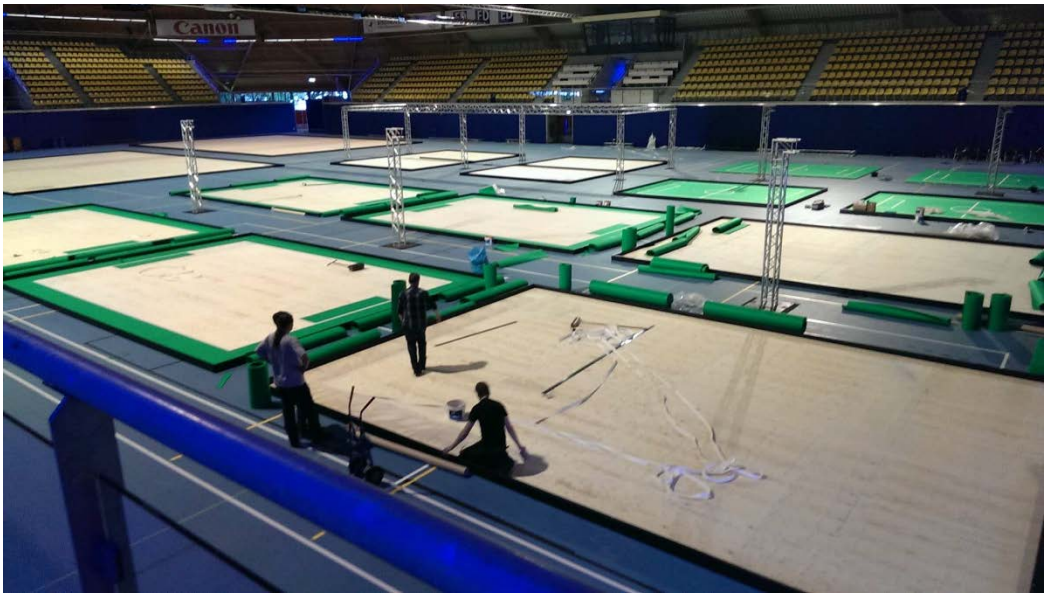
2. Add a **strong border** around the field. Note that the robots may weigh as much as 40 kg, and reach velocities of up to four meters per second, which corresponds to a kinetic energy of 320 Joule. Although robots crashing into the field border will be penalized with a red card,

for safety reasons it is fundamental that the field border is build and attached in a way that ensures it can sustain a robot-crash under the described worst-case conditions. Height of the border should be between 8 and 15 cm (above the wooden floor).



3. Next, draw the lines of the field on the wood.

4. Glue green carpet to the wooden floor at areas of the field that are not covered by white lines, and glue white strips of carpet to the floor where the lines should be.



Using white-colored carpet has proven to be the most reliable way of adding lines to the field. If for some reason this is not possible, using duct tape or white paint are next best solutions. A type of tape that has been successfully used before is: ‘Tesa Extra Power White’, 50mm width, refs 56388-02 or 56389-02. When using paint, please note that several layers are required before green-white contrast becomes sharp enough for the robots to recognize.

5. If necessary, put commercial panels around the absolute border of the field (outside of the 1.5 meter safety region). Panels should be max 1.5 m in width and max 0.5 m in height. They can have any arbitrary color, also colors that match e.g., the color of the ball.

The field is ready for competition!

Required Materials per Competition Field

The number of required fields depends on the number of participating teams. In case multiple fields are used, all of the materials in the table below are required for each of the competition fields.

Item	#	Description
Field	1	Green carpet, mounted on wooden base, with white markings (for more instructions, see Playing Field Dimensions and Constructing a Field).
Goals	2	White wooden made goals (for more instructions, see Goal Dimensions).
Referee computer (RefBox PC)	1	Computer running Linux or Windows OS in English version. During a match both teams will connect to this computer, software to do so will be installed by the RoboCup MSL OC.
PC Speakers on the RefBox PC	1	For the referee to hear the 7 seconds counter.
Extra Monitors for the RefBox PC	1	Show the referee client - displays time, score, robot repairs, etc. for the main referee. It is much better to use a large screen LCD, just stand beside the Referee table.
Access point	1	One access point supporting IEEE 802.11a/g/n (5GHz), enterprise level. For 802.11a/g/n (5GHz), **Middle Size League needs channel 40 & 44 for competition and practice.** The access point will stand on the referee table (for more instructions, see Frequently Asked Questions)
Network cable	5	Each approximately 5 metres in length.
Network switch	1	With at least five slots.
LCDs	2	To connect to the base stations laptops of teams (teams notebooks must be closed during games).
Referee & Team tables	3	-
Referee &Team chairs	6	-
Power plugs	2	2 kW each.
Multi-outlet power strips	2	With at least nine connections.

Whistles	10	For all referees (No yellow whistle).
Red and yellow cards	1	Preferably plastic.
Tournament ball	1	Color to be decided by OC, FIFA size 5. (Prepared by OC) An arbitrary ball, FIFA size 5. (Prepared by LOC)
Internet connection besides the field	1	Make the live show via internet, such as YouTube or other website, MSL needs the internet connection besides the filed, opposite of the referee tables. At least 50MB/s upload. We also need one power plug and one table at this point.

Nice to have items:

Item	**#**	**Description**
Sound System and Public Announcer	1	To comment games to the audience (explaining what's going on and reporting as a 'Football Commentator').
Referee shirt	3	Special black/grey T-shirt for referees such that everybody can easily identify them.
Chairs for team	20	Chairs for team members to follow the game.
A big screen on top of one of the fields	1	To use the Audience Client to show to the audience. For this to work, we need: > - Extra PC with Ubuntu 16.04 installed and internet connectivity to install required packages > - This PC has to be connected to the field network > - VGA/HDMI/DVI splitter to be able to have a preview of what the audience is seeing (in case the screen can't be seen from the RefBox table)

Other Required Materials

Team Area:

Item	#	Description
Team tables	-	Enough to provide seating places for all registered team members.
Team chairs	-	One for each registered team member.
Power plugs	-	One per team, 2 kW.
Internet connection cable	-	One per team.

Organizing Committee (OC):

Item	#	Description
Table	2	-
Chairs	3	-
Team leader meeting tables	4	Only in case a specific area for meetings is not available.
Team leader meeting chairs	10	Only in case a specific area for meetings is not available.
Printer	1	**Color printer**
A4 white paper	1	-
Chronometer	3	-
Color obstacles	4	Required for technical challenge. Size: 50x50x80 cm, or 50cm diameter x 80 cm height. Obstacles are of saturated single color. Green, white, black and the color of the ball are excluded as valid obstacle colors.
Tape measure	1	At least three meters in length. To check robot specifications and for referee to check robot positioning during free kick in case of objections.
Whiteboard	1	For announcements of OC and publication of results
Pushpin or magnet sticks	20	For sticking schedules and results on the announcements board.

Power plug	1	2 kW
Multi-outlet power strip	1	With at least three outlets.
Internet connection cable	1	Internet connection.
Network cable	4	Each approximately 3 metres in length.
Network switch	1	With at least five slots.
Field repair	-	Tape, tools and other materials needed to repair the field in case of damage.

Public viewing area:

Item	**#**	**Description**
Info screen (e.g large LCD)	2	To display relevant information to the audience and teams, such as audience visualization, team info, game schedule, game results, etc. One for each field, at the corner near the public area or hang on top of the field. Beamber/projector or large screen LCD
Computer	2	For MSL Audience client. With Ubuntu 16.04 and connection to field network. Connects with Info screen (video cable) and field switch (ethernet cable).
Info screen connection cable	2	One for each screen.

Volunteers:

Item	**#**	**Description**
Volunteer	2	At least one in a permanent basis.

Frequently Asked Questions

1. Considering lighting, what are the requirements of the league?

Standard indoor lighting, like tl-lighting for instance, will suffice. We need approximately 600 lux. What's most important is that illumination conditions are equal across the field, such that shadows cast by the robots or other objects are kept to a minimum. Also it's important that lighting conditions don't change during the day. So no direct daylight.

2. How many TVs/projectors will your league need?

We need one TV screen allocated to the MSL competition area, with VGA interface. This TV will be used by the teams to present their work during the Scientific Challenge. The Scientific Challenge is an official challenge for which the winning team is awarded with a trophy.

Television screens for the general public are also nice to have. Content for these screens is usually taken care of by the LOC but we as MSL committee can help of course (e.g., providing the competition schedule with some brief explanation, videos and pictures of previous tournaments etc).

3. What is the ideal SOUND equipment for your league?

Sound equipment is not a requirement for the competition itself, but very valuable for spectators. Especially if the LOC can arrange somebody who can explain what is going on and be a 'football commentator'. Commenting in English would be nice but during previous tournaments the commentators often spoke the native language of the audience, which is nice as well. Have a look at this video for instance:
http://youtu.be/dPa5a9nUCAs

4. In terms of wireless network for league participants, what are the league requirements?

In MSL, wireless communication is a key issue. The game heavily depends on wireless communications and, when conditions are bad, games may have to be interrupted, with an undesired impact on competition schedule as well as on audience expectations about the game. Thus, to minimize communication problems, it is very important to use recognized quality equipment.

Each field of competition is equipped with the following communication elements, which should be provided by the local organizing committee (LOC):

* One Access Point working in IEEE 802.11a/g/n, enterprise level.
* For 802.11a (5GHz), Middle Size League needs channel 40 & 44 for competition and practice. These two channels had been used in recent 3 years, all teams can use these channels.
* One switch with, at least, five ports (and five network cables of at least three metres).

If other competitions are expected to be located near the MSL fields, it would be a good practice to predefine channels to the different competitions so that minimal interference

occurs.

Page 93 of the rulebook contains info on how the routers need to be configured: https://msl.robocup.org/wp-content/uploads/2018/12/Rulebook_MSL2019_v20.pdf. In addition to the information provided in the rulebook, the AP configuration, regarding SSIDs, should be done in the following way (assuming the venue will have two MSL fields):

Field A:	AP in A mode, SSID: MSL_FIELD_A_a
	AP in G mode, SSID: MSL_FIELD_A_g
	AP in N mode, SSID: MSL_FIELD_A_n
Field B:	AP in A mode, SSID: MSL_FIELD_B_a
	AP in G mode, SSID: MSL_FIELD_B_g
	AP in N mode, SSID: MSL_FIELD_B_n

5. When will the leagues responsible team (OCs, TCs, EXECs) intent to arrive?

Usually on the day first official setup day for teams.

6. WHO will be the responsible for running the league in the venue?

Names of EXEC/TC/OC members are listed here: https://msl.robocup.org/2019-committees

7. What conditions local organizers should PROVIDE for the arrival of OCs/TCs/EXECs, and what will be made in the venue by OCs/TCs/EXECs?

On the first official setup day we need the fields to be ready. Also the team area needs to be ready with power and internet for each block of tables. For the competition fields the router has to be in place and configured and the referee pc needs to have an operating system running. Software to connect the referee pc to laptops of the participating teams will be installed by us.

8. Will you need any special tools for assembly or maintenance of your league?

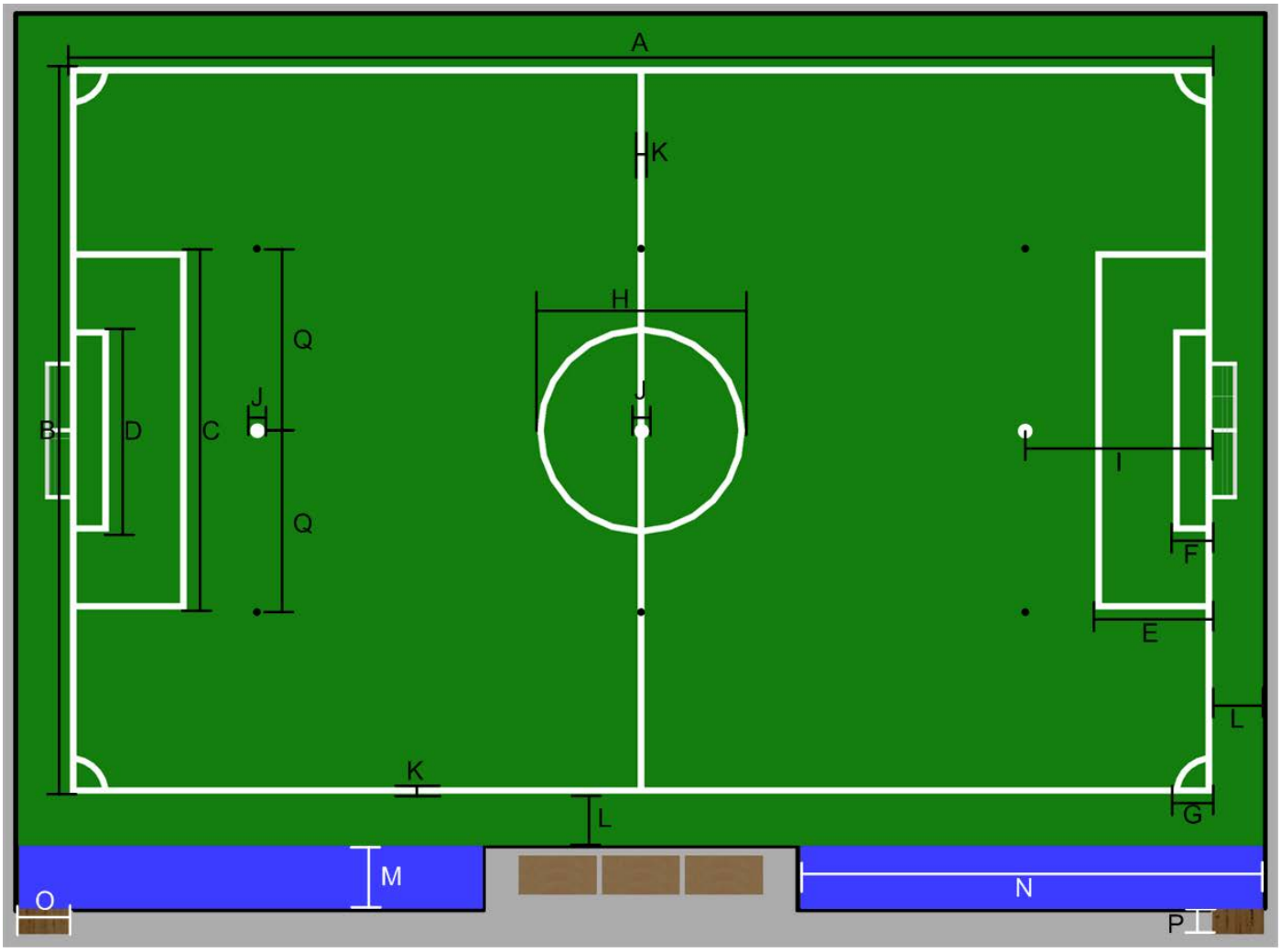
Teams will bring their own tools. Other than what's specified in the Required Materials per Competition Field and Other Required Materials. We don't need additional tools.

9. Does your league require any other kind of professional to setup?

In order to prepare the fields you'll need a carpenter to create the wooden sub-floor, a 'carpet-professional' for the carpet and/or artificial grass, and a WiFi professional to configure the network. During the tournament it would be good to keep these people on stand-by (not necessarily stand-by on the spot but on a call basis).

12. From your previous experience in RoboCup, what are the usual problems that we can try to avoid for your league?

(i) WiFi interference with other leagues: SSL and Rescue leagues usually cause significant WiFi interference in MSL games. This problem can be minimized if the fields of these leagues are not so close to our fields. (ii) Goals not strong enough. (iii) Border of the field not strong enough. (iv) Carpet damage, especially in the goal area. (v) Lines of the field don't hold. (vi) Poor communication to spectators: The audience needs somebody who explains what is going on and why playing soccer with robots is a challenging scientific problem. (vii) Poor communication via the tournament website: People who are interested in RoboCup soccer but are unable to come to the venue should be kept up to date with respect to standings and preferably also with live reporting.



A = 22m	B = 14m
C = 6.9m	D = 3.9m
E = 2.25m	F = 0.75m
G = 0.75m	H = 4m
I = 3.6m	J = 0.15m (center and penalty marks)
K = 0.125m (all lines width)	L ≧1m
M = 1m	7m≦ N≦8m
O = 1m	P≧0.5m
Q = 3.5m