

# Robotics



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Adapted from Skills Canada 2017 National Robotics Challenge

## ***Introduction***

Below is a contest description for a 2017 Skills Canada Nova Scotia Robotics Challenge. This “Football Game” challenge was designed to closely represent the national competition in Winnipeg that top team from each province will advance to. Competitors must be aware that the national competition will have a new element that will not be present at the provincial level.

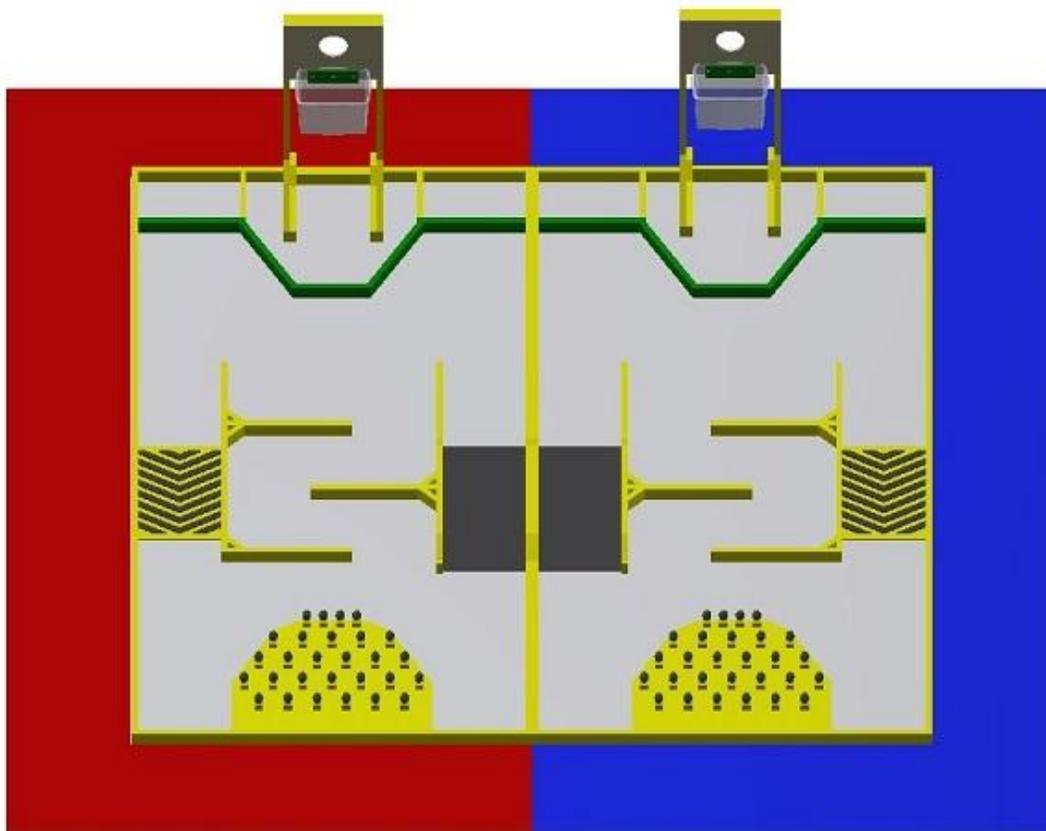
The 2017 Skills Canada National Robotics Competition will implement on site design and construction of autonomous robots, which was never seen in previous years. The competition will be split into two parts, first of which will have the familiar competition of pre-built robots for the football game challenge on day 1. During the second day students will have to build autonomous robots on site to compete in a completely new set of tasks that will only be released to them the 24h before. Students will have the option to use their own parts or use a kit provided by the organizers.

Teams should follow Skills Canada website for more details on the National Finals Robotics Challenge. A complete scope document with this information will be available later this year.

# ***The Football Game***

The game is inspired by Football with three options to score points. Teams may choose higher reward but difficult approach of shooting footballs into an elevated target or a simpler task of delivering them past a small barrier on the floor.

## ***Court Description***

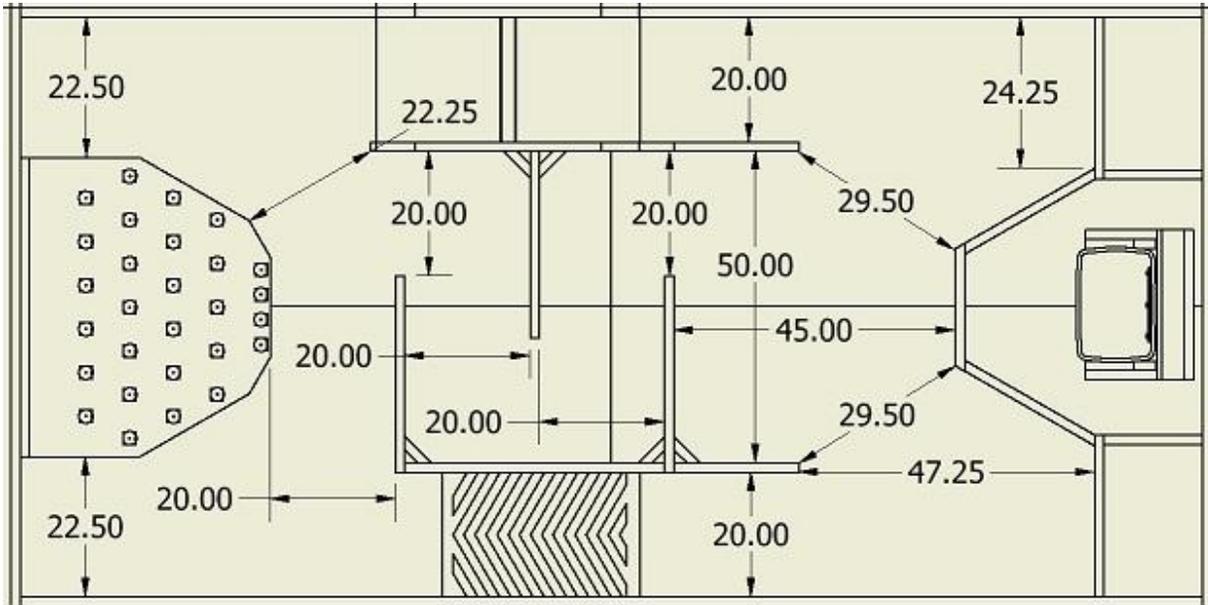


### **1. Overall Layout**

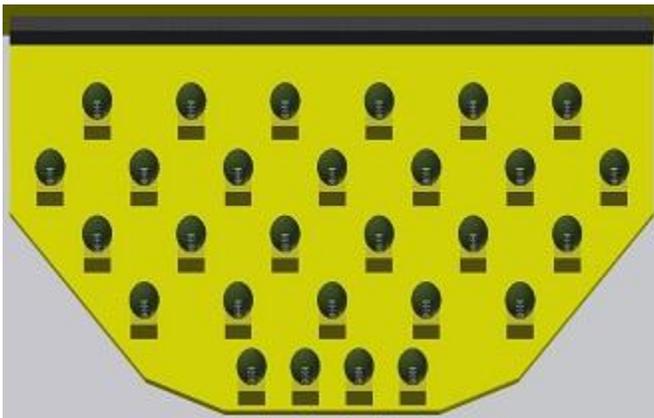
Each team will have exclusive use of half of court space (approximately 8'x16') as shown below. There will be minimum 20" wide passage between any barriers on the field. The court surface

will be made from medium grade unpainted plywood. The perimeter court wall, passageway sides and the end zone line / barrier are made from 2 by 4 inch lumber stood up on the narrow side.

Please allow for 1/2" tolerance to any court dimensions.



## 2. Football Platform



Each court has a football platform (3/4" plywood sheet) where 28 sponge footballs are located. These footballs are positioned in a grid pattern on fixed in place stands. All Footballs will be placed on 2.0 x 2.0 x 1.5 in tees ( wooden blocks) that have a 1 in Diameter 0.75 in. deep hole in the center of their top surface. The tee blocks have 5in. spacing between the rows with the exception of the front row where the spacing is 2 in.

The Game Footballs are 3" long mini foam footballs. All schools preparing a 2017 Skills Canada Robotics Team in any province or territory will be provided with 36 Mini-footballs at no cost to the school by Studica.

Schools requesting a Competition Set of Mini-footballs **MUST NOT** contact Studica directly to request their footballs.

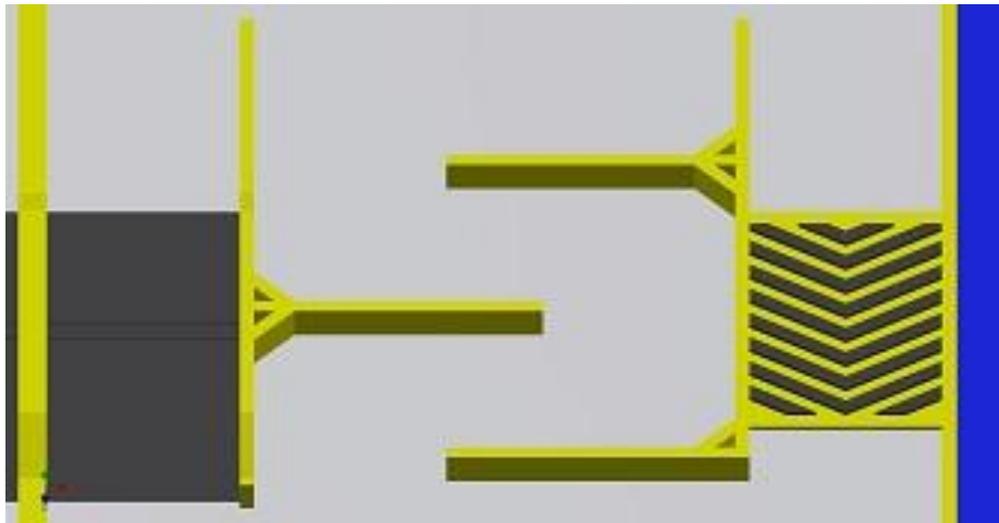
Schools requesting a Competition Set of Mini-footballs **must email** Bob Tone, 2017 Skills Canada National Robotics Technical Chair, at [bobtone@rogers.com](mailto:bobtone@rogers.com) providing the following information:

- The name of your school and school board
- The name and email address of the teacher advisor supporting your team
- The full school mailing address, the school phone number and fax number

Teams may choose to obtain footballs from many online retailers including amazon.ca

[https://www.amazon.ca/Mini-Foam-Football-12-pack/dp/B00C7CHAGQ/ref=sr\\_1\\_6?ie=UTF8&qid=1473688169&sr=8-6&keywords=football+foam](https://www.amazon.ca/Mini-Foam-Football-12-pack/dp/B00C7CHAGQ/ref=sr_1_6?ie=UTF8&qid=1473688169&sr=8-6&keywords=football+foam)

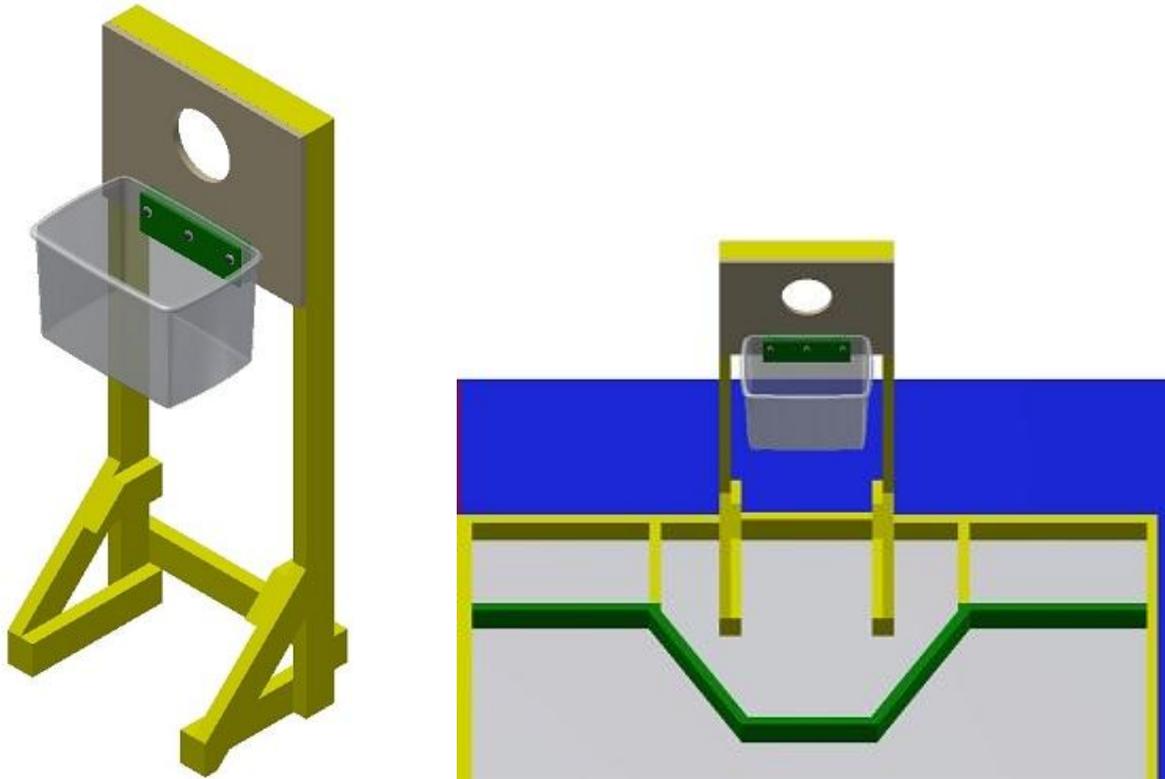
### 3. Transition Zone



The Transition Zone separating the football platform from the scoring area provides three travel options:

- A Straight Line Path that includes travel over a Two-Sided Ramp. Please note that the ramp will be constructed from 1/2" thick plywood that will not be miter cut. This will create approximately 1/2" tall lip for robots to overcome.
- A Straight Line Path that includes travel over a bumpy road section. This will be made using standard 2x4 lumber pieces placed on their side to create 3.5" tall obstacles.
- A Winding Path that provides a Flat, Smooth Surface at ALL Times

#### 4. Scoring Area



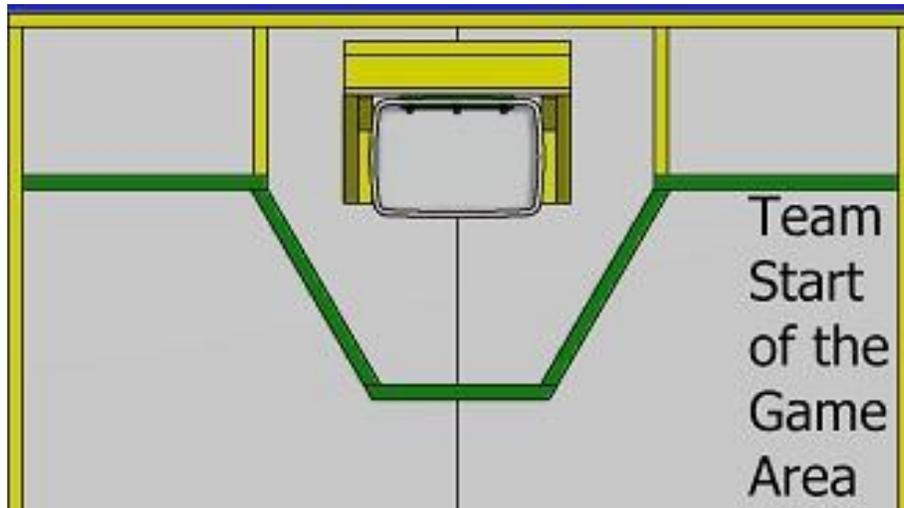
The Scoring Area is divided from the rest of the court by a barrier marking the “end zone”  
Placing a football in the end zone (behind the barrier) will be scored as a “Rushing Touchdown”.

The end zone also contains “Receiver’s Hands” (the bin on a stand). The bin used is a Canadian Tire 28 L Ultra Latch Bin, Product ID: 142-0954-2 cost \$13.99 (CAN), approximately 16”x12”. The top edge of the bin will be positioned 48” above the court floor. Placing a football in this bin will be scored as a “Passing Touchdown”



The backboard of the bin will have a 7" diameter opening hole. Shooting a football into this hole will be scored as a "Hail Mary Touchdown"

Each Team's Entire Entry (single or combination of robots) must be in the Starting Position **and** in compliance with the Overall Maximum 4 Cubic Feet Size Restriction. The Starting position will be in the corner of the court near the end zone as shown below.



Additional details about court and component dimensions may be found in the appendix at the end of this document.

# ***Game Rules and Scoring***

1. **During game play, referees will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.**
2. Tournament Standing will be determined based on the Total Points Scored in ALL Tournament Games played by each Team.
3. Teams will play in an equal number of Tournament Games.
4. Tournament games will last 4 minutes.
5. The amount of time between games will be determined by the number of participants. This information will be provided to teams at the start of the tournament.
6. Games will start on time. Teams are responsible to know when their games are scheduled. Teams arriving late will be allowed to use the remainder of the time in the game.
7. Competitors cannot enter onto the court surface or make adjustments to their robot during a game.
8. Damaging the court area is illegal. If a robot's design causes damage to the footballs, or court elements, then it will not be allowed to compete until it can operate without causing damage. Games missed due to this situation will be forfeited.

NOTE: Damage is considered to be BREAKING court components. Robots bumping into court components and causing them to shift position without breaking any court element will NOT be considered to be damaging the court. It is expected that all court components will be fixed firmly in place so that the court is a neutral factor in the competition.

9. If a robot is malfunctioning and represents a hazard to participants, other robots or itself in the opinion of the Referee, then, the referee may stop the clock, and may authorize the shutting off of the robot during a game. Disabled robots or parts of robots not generating any safety concerns will be left on the court until the game time expires.
10. One Point will be awarded for each Football delivered into the End Zone (Running Touchdown)
11. Two Points will be awarded for each Football delivered into the Receiver's Hands (Passing Touchdown)
12. Three Points will be awarded for each Football delivered through the Backboard Hole (Hail Mary Touchdown)
13. At the start of a game, robots must be in their Team Selected Starting Positions.
14. Robots may reach over the End Zone Line / Barrier BUT Robots may NOT Touch any element of the court within the End Zone.
15. Robots are NOT allowed to climb onto the End Zone Line / Barrier or to grasp hold of the End Zone Line / Barrier
16. No Part of a Robot may make Direct Contact with the Receiver's Hands (Bin) or the structure supporting it. (Touch or Lean on these items for Support)

17. Robots are ALLOWED to contact / touch the Front of the End Zone Line / Barrier or to reach over it.
18. Balls CANNOT be retrieved from the End Zone and put into play a second time
19. Footballs MUST be completely free of contact with the robot when the end of the game Buzzer sounds for points to be awarded.
20. Robots must stop all operation when the End of the Game Buzzer Sounds.
21. It will be a referee's ruling that decides if an 'End of the Game 'Football Delivery' took place before or after the game-ending buzzer sounded.
22. Teams will NOT be in possession of a Football at the Start of a Game.
23. Each Team's robot CANNOT be in possession of more than one Football at any time.
24. If a team enters two independently controlled robots they may possess one football each
25. Teams may also have Independent Autonomous Elements as part of their entry. These elements may possess ONLY ONE Football at a Time each and these Football(s) do NOT count against their Team's Maximum Two Footballs at a time limitation.
26. Footballs miss shot by Teams that land in an Opponent's End Zone or Receiver's Bin will remain where they landed and will score Touchdown Points for the Opponent Team at the end of the game.
27. Teams may have up to two drivers and two spotters which must stand in the designated places around the court. Teams may choose to switch roles during the game play provided the radio controllers do not leave the driver designated area.

## ***Robots***

1. ALL Robots must **pass** a pre-competition inspection for compliance with the safety and design rules before they will be allowed to participate in tournament games or practice on the court floor.

Note: Robots must remain in compliance with these rules throughout the competition. If teams fall out of compliance with these rules then they will not be permitted to compete and will forfeit all of their scheduled games until they have corrected the problem.

2. Team entries may be one or a combination of multiple robots. Teams are allowed up to two remote controlled robots and unlimited number of additional autonomous units such as a football launching devices.
3. The autonomous unit does not have to be mobile or powered but must comply with all the same rules as remote controlled robots.
4. Complete Team Entries (all the robots/autonomous units together) must not exceed an overall size of **4 cubic feet** (6,912 cubic inches) at the start of each game.
5. Team Entries may expand to a larger size once a game has started.

6. Overall Team Entry Size will be calculated by using the maximum single dimension in each category (Length / Width / Height) of the Complete Team Entry not average dimensions.
7. It is recommended (not required) that all teams use digital radio systems on remotely controlled Robots.
8. Teams are allowed the use of an unlimited amount of channels, but only two separate remotely controlled robots.
9. Teams assume full responsibility if any interference is to occur with their respective communication systems that could render the robot(s) inoperable.
10. Remote controlled robots may not transmit audio/visual information to off the robot devices. (Ex: Having a camera transmit images real time to a computer near the driver, etc.). Cameras for the purpose of recording are allowed
11. No aerial robots are allowed.

When a robot's main power is turned on prior to the start of a game the robot must be in an overall 'Idle State' and the following conditions must exist:

1. Robots must be stationary
2. Robots must be in their Team Selected Starting Location.
3. If Team Entries involve multiple Robots / Mechanisms then all of them must be placed in the team selected starting location and must be positioned to not exceed the allowed total 4 cu ft. volume per Team.
4. All systems may be ON.
5. Air System Circuits may be fully charged to 100 PSI and their compressors can be ON.

### **Electrical Power Sources and Management**

1. The total voltage in any individual circuit cannot exceed 24 Volts.
2. The maximum continuous power rating allowed in any circuit is 240 W, which will be limited by voltage and fuse selection. To calculate power in any given circuit, use the following formula:

$$\text{Power (Watts)} = \text{Voltage (Volts)} \times \text{Current (Amps)}$$

3. Teams are reminded that it is the purpose of a fuse to protect the students themselves and the equipment in their circuits. Teams must develop circuit diagrams, and calculate the appropriate values for all circuits on their robot. Teams must submit a wiring diagram of their robot's circuits.
4. Each current branch path from the battery must include either an in-line fuse, resettable fuse, circuit breaker, or be connected to a dedicated fuse in a rack.
5. Batteries must be complete sealed commercial battery packs.
6. Individual Robots must be able to be turned off with a single motion.
7. Robot Controller receivers may be in an independent circuit.
8. No explosive materials of any kind may be used (ether, gunpowder, acetylene etc.).

### **Non Electrical Power Sources**

Pressure based energy sources (air or other) may be pre-charged to a maximum of 100-PSI pressure in their reservoirs (cylinders) at the start of each game.

1. Air pressure systems using Competitor-made or modified air pressure hardware are **NOT** permitted.
2. All pressurized tanks on robots must have a pressure gauge to indicate the stored pressure and a form of automatic overpressure safety relief system.
3. The pressure tanks and related gauges / controls must be shielded from damage due to collisions or flying target objects.
4. The stored pressure in the tank must not exceed a maximum of 100 PSI at any time.
5. Tension-based energy sources (elastics, springs or other) may be in either a relaxed at rest state or in a tense / compressed state at the start of each game.
6. Laser devices are prohibited.

## ***PIT AREA***

1. A pit area is provided so that students may make repairs and improvements to their robots between games. (Note: Teachers are not permitted in the pit area once the competition has started).
2. If registration/orientation day is separate from the competition day (to be announced at a later date) the competitors who arrive the day before will not be able to remove their robots from the Pit Area overnight.
3. Designated teacher/industry team advisors are permitted in the pit area **only** to inspect the worktable setup of their team prior to the start of the tournament.
4. Designated teacher/industry team advisors are **not** allowed in the pit area during tournament play.
5. Teachers and industry advisors are not permitted to handle tools or robot parts. Students must affect all repairs and modifications on their robot.
6. Only registered robot competitors are permitted in the pit area.
7. It is required that teams fabricate a **tabletop stand** for holding their robot(s) in the pit area. This stand or these stands should hold the robot(s) securely and be capable of preventing the robot(s) from driving on or off the table in the case of either deliberate motor testing during repairs or due to random, unexpected motor activity.

8. Each team will be assigned a worktable in the pit area and will have access to a standard 120V, 15A dual receptacle outlet.
9. Teams are expected to bring their own tools and supplies needed to work on their robots.
10. No food or drink will be allowed in the pit area.
- 11. During the competition, protective safety glasses are to be worn at all times while in pit area and operating the robot on the court. Additional Personal Protective Equipment such as work gloves must be worn while cutting, drilling etc.**
12. Use of Angle Grinders is not permitted in the pit area. Teams will be allowed to use them in a designated area under staff supervision upon request.
13. The pit area and competition court may be available to teams to work or practice during lunch breaks.

**PRE-INSPECTION FOR COMPLIANCE WITH SAFETY AND DESIGN RULES**

- Mandatory Wiring Diagram provided.
- Table Top Robot Stand
- Overall volume  $\leq 4 \text{ ft}^3$  or  $6,912 \text{ in}^3$**
- No explosives/combustibles
- No lasers
- All batteries are sealed commercial batteries in good physical condition
- Batteries wired in series should be the same amp hour rating (ex. both 1500 mAh) and batteries in parallel are of same voltage (ex. both 12 volts).
- Batteries securely mounted
- Total voltage in any individual circuit does not exceed 24V
- No circuit exceeds 240W (Voltage x Fuse Current Rating, easily accessible)
- All circuits have a fuse or breaker (breakers must have **DC rating**) and all Fuses / Breakers must be readily accessible.
- Mandatory Pressure System Circuit Diagram provided.
- No Competitor-made or modified air pressure hardware being used.
- Only commercially manufactured Pressure Tanks (cylinders) can be used.
- Pressure indicator
- Pressure in tanks does not exceed 100 psi
- Over-pressure safety valve
- Pressure tanks and related gauges and controls are shielded from damage due to collisions
- Robot is able to be turned off with a single motion.** Radio receivers / Logic circuits may be independent of the kill switch.
- Control unit to support operator to robot communication are being used.
- Demonstration of robot functionality

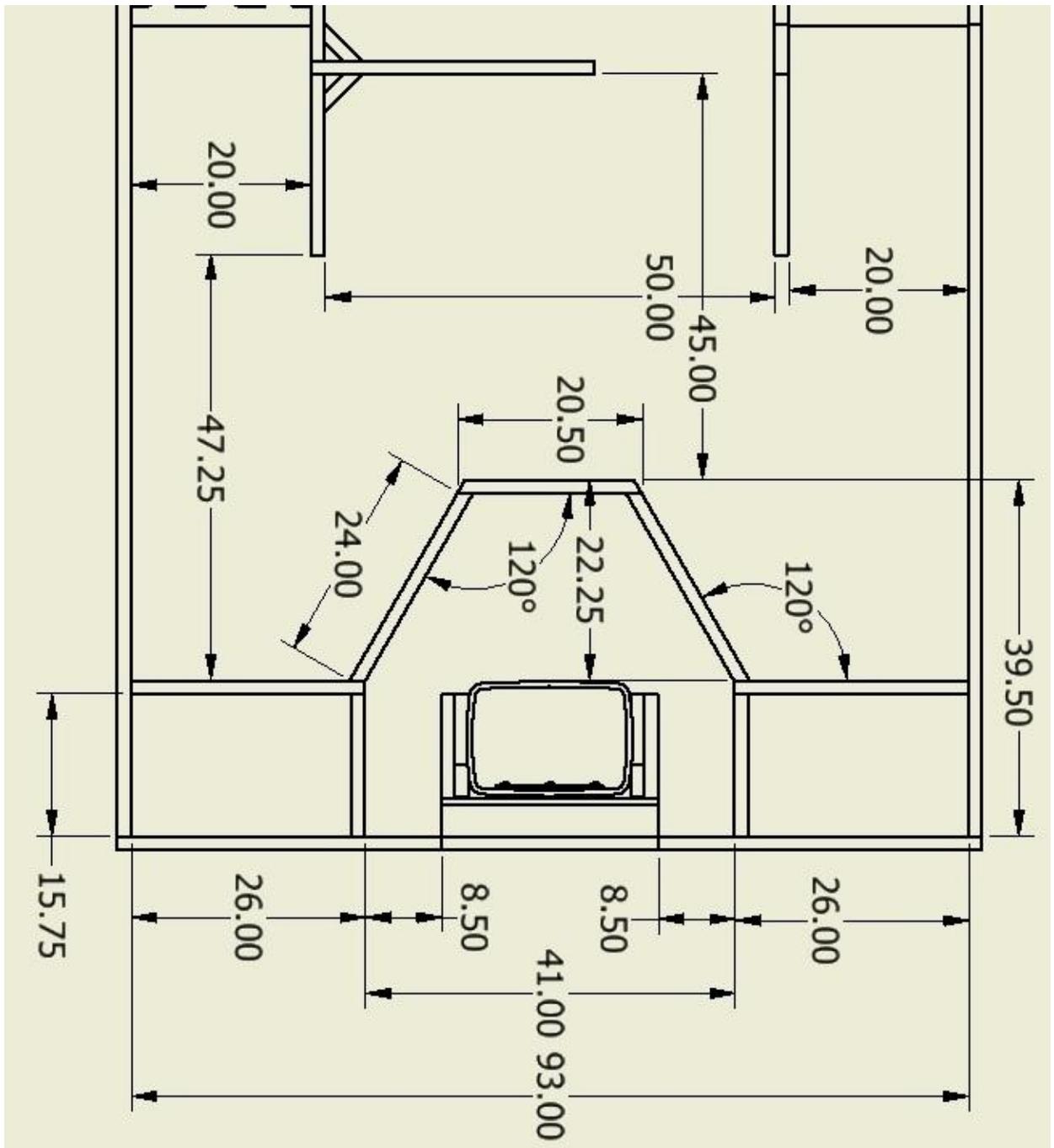
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Additional concerns:  
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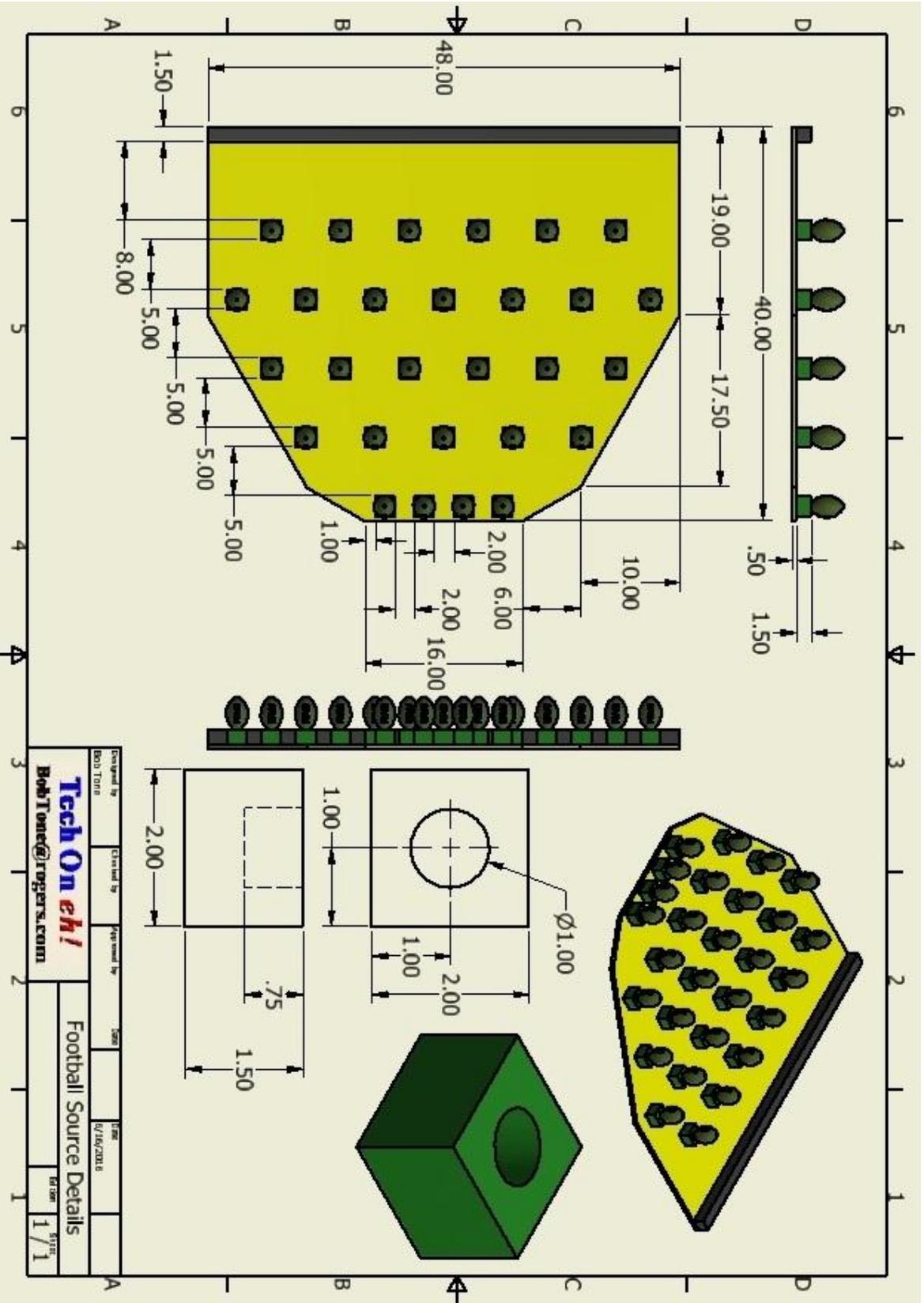
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Robot Evaluator Signature

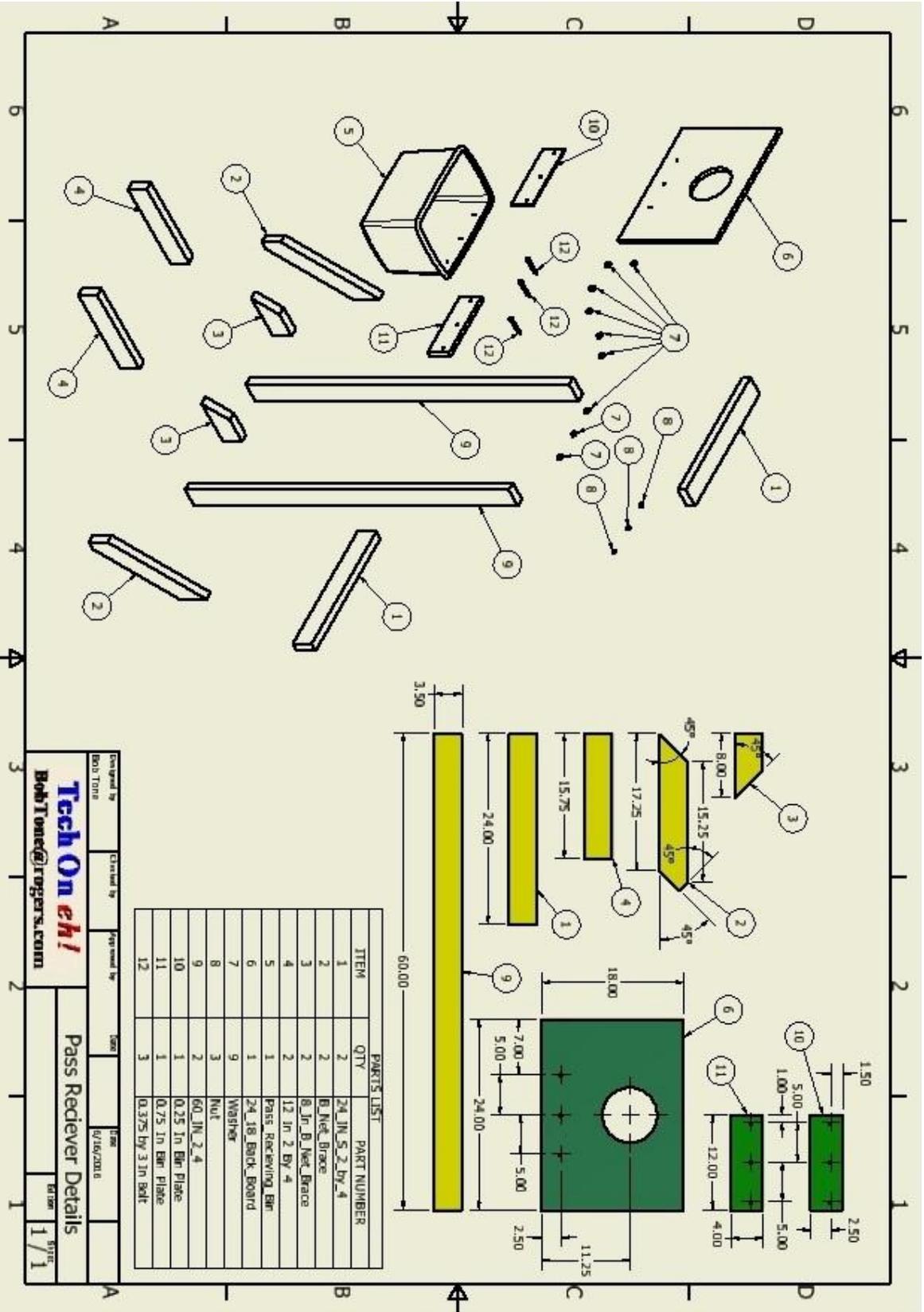
Team Representative Signature

# Appendix





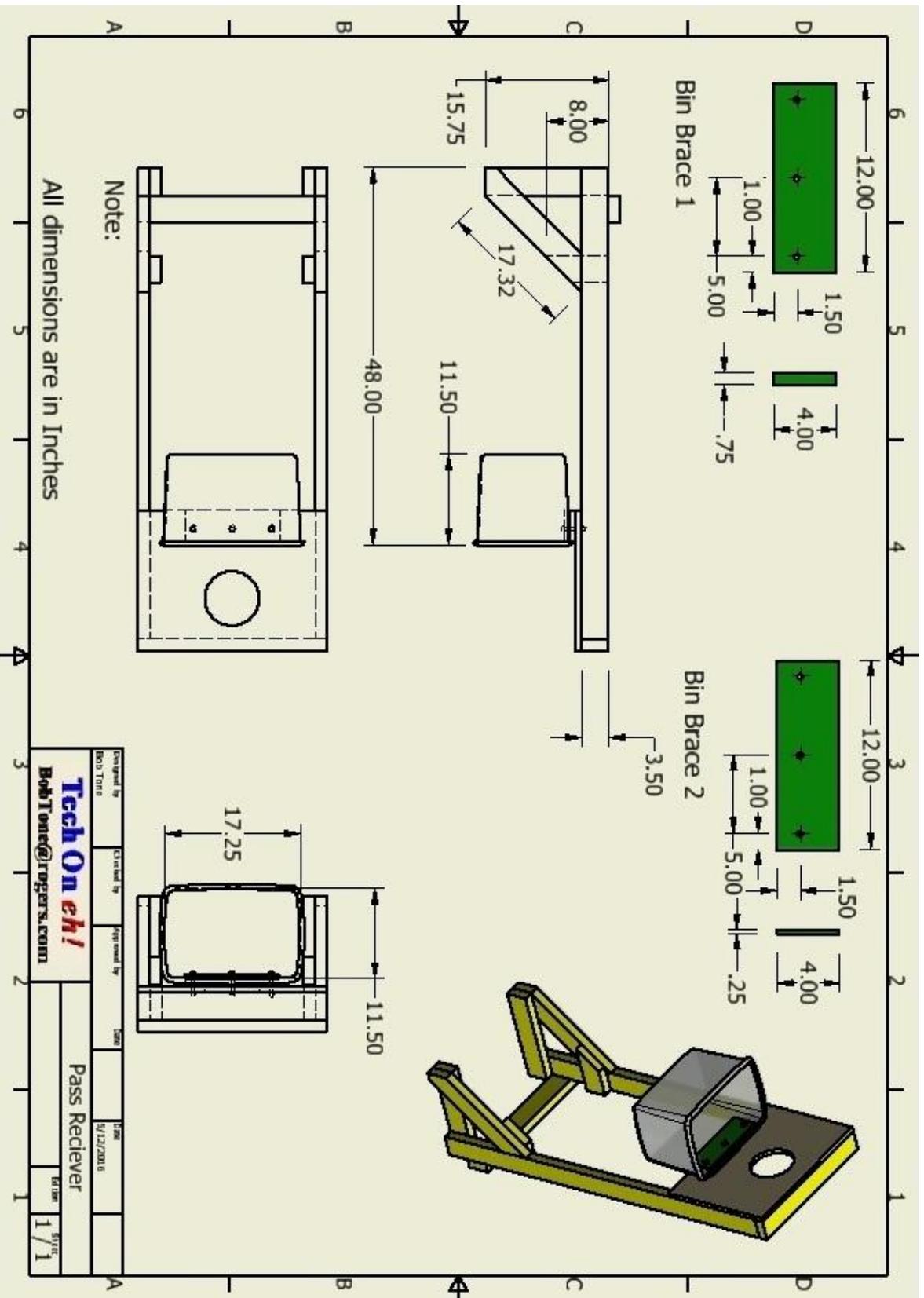
Drawn by: Bob Toner  
 Checked by: [ ]  
 Approved by: [ ]  
 Date: 6/16/2016  
**Tech On eh!**  
 Bob Toner@rogers.com  
**Football Source Details**  
 Date: 1/1



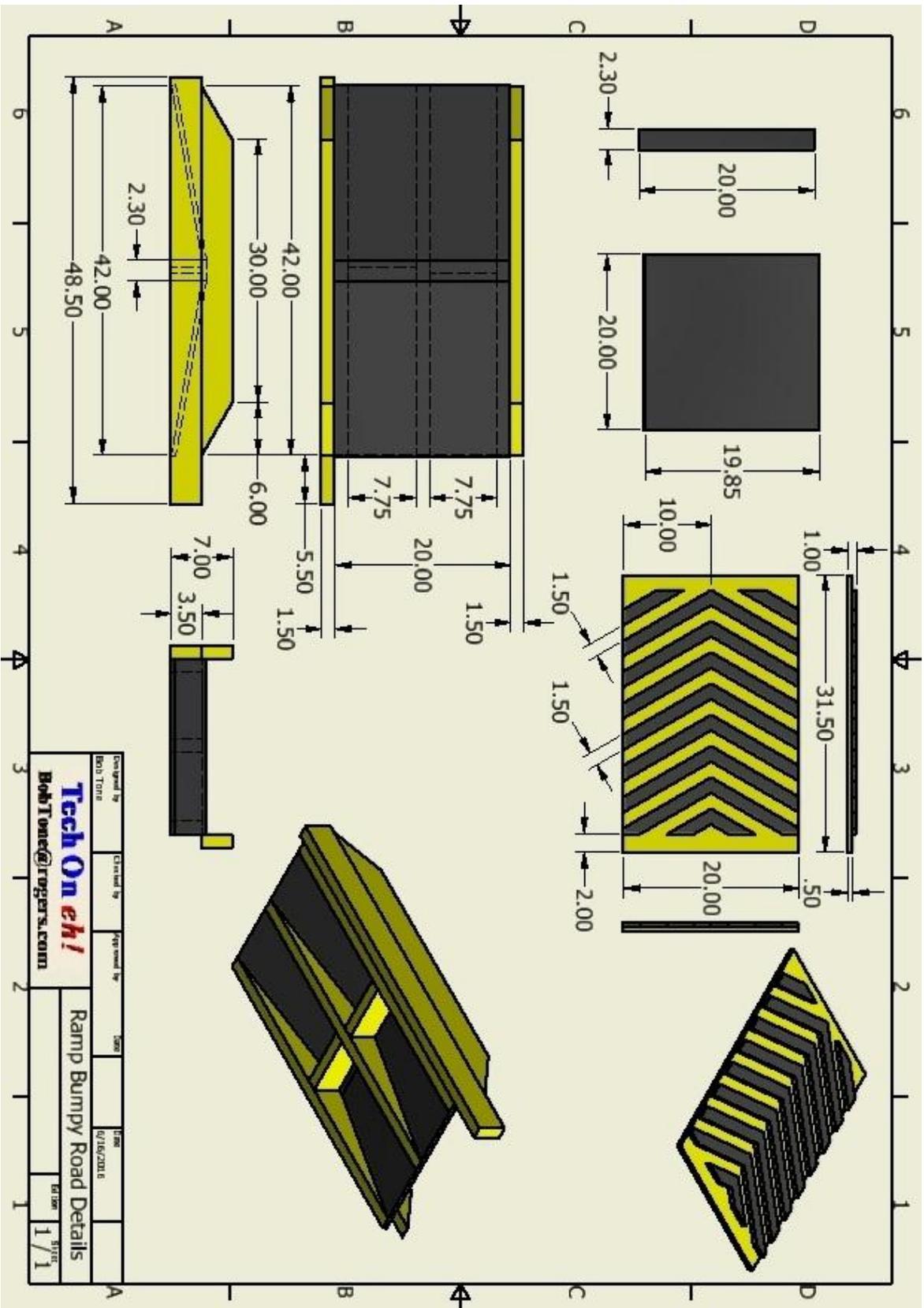
ITEM	QTY	PART NUMBER
1	2	24_IN_5_2_by_4
2	2	8_In_5_2_by_4
3	2	8_In_8_Nut_Brace
4	2	12_In_2_By_4
5	1	Pass_Receiver_BM
6	1	24_18_Back_Board
7	9	Washer
8	3	Nut
9	2	60_IN_2_4
10	1	0.75_In_BM_Plate
11	1	0.75_In_BM_Plate
12	3	0.375_by_3_In_Bolt

Drawn by: Bob Tonne  
 Created by: Tech On eh!  
 Approved by: Bob Tonne  
 Date: 6/16/2016  
 Title: Pass Receiver Details  
 Revision: 1/1

**Tech On eh!**  
 Bob Tonne@trappers.com



Designed by BOB TONE	Checked by	Approved by	DATE	DATE	DATE
<b>Tech On eh!</b> Bob Tone@rogers.com			1588	5/12/2016	
<b>Pass Receiver</b>					
			1/1	1/1	1/1



Designed by: **Bob Toner**  
 Client: **Tech On eh!**  
 Prepared by: **Bob Toner**  
 Date: **6/16/2016**  
**Ramp Bumpy Road Details**  
 Scale: **1/1**

