

# SKILLS ONTARIO COMPETITION

## Robotics (Team of 4) Secondary

**Contest Date:**

Monday May 4<sup>th</sup> to Wednesday May 6<sup>th</sup>, 2020

*Sign in starts at 7 :00 am on the contest site*

Last Updated: Oct 2019

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To ensure that competitors have a positive experience at the Skills Ontario Competition, a competitor and their educator should review the scope document well in advance, as well as check back to the website for updated versions of the scope up until the event.

For technical questions that are contest specific, please contact the technical chair – Bob Tone at [bobtone@rogers.com](mailto:bobtone@rogers.com) or the Skills Ontario competition department at [competitions@skillsontario.com](mailto:competitions@skillsontario.com).

If you have any questions regarding the Skills Ontario Competition or this contest, please contact Skills Ontario or the technical chair prior to April 17, 2020, as all staff will be onsite setting up the following week and cannot guarantee a response.

### TECHNICAL CHAIRS

Bob Tone, **Tech On eh!** [bobtone@rogers.com](mailto:bobtone@rogers.com)

### SKILLS ONTARIO COMPETITIONS DEPARTMENT

[competitions@skillsontario.com](mailto:competitions@skillsontario.com)

## 1. COMPETITION INFORMATION GUIDE

Both the **Competition Information Guide** and contest **Scope** **MUST** be reviewed in full for all pertinent and vital information in regards to the competition.

The Competition Information Guide can be found at <http://www.skillsontario.com/competitions/secondary>

Examples of required information from the Competitions Information Guide to accompany the Contest Scope:

- |   |   |
|---|---|
| • Competitor Eligibility                          | • Team Ontario                                      |
| • Competitor Rules & Regulations                  | • Space Reservation/ Registration/ Wait List Policy |
| • Conflict Resolution Procedure                   | • Closing Ceremony/ Ticket Purchases                |
| • Skills Canada National Competition/ WorldSkills | • Spectators  |

### 3.0 DEFINITION OF TERMS REFERENCED IN THIS DOCUMENT

- 2.1 Tele-Operated Robot Elements are elements under the direct / active control of competitors during game play using one or two radios / game controllers held by the courtside competitors
- 2.2 Mobile Independent Autonomous Mobile Robot Elements are elements that at the start of a game have a competitor pressing their start button or enter on a computer keyboard as the only competitor to Independent Autonomous Mobile Robot Element communication during the entire game.
- 2.3 Stationary Independent Autonomous Elements are elements that have their power on at the start of games but have no direct contact with a competitor during game play. These units may interact with the team's tele-operated mobile robot with the actions of the tele-operated mobile robot triggering an active response by the Stationary Independent Autonomous Element which may be managed either by a mechanical based system (eg. A series of limit switches / no programmed elements) or a pre-programmed system (eg. Managed by an Arduino or other microprocessor) internal to the Independent Autonomous Element.

### 3.0 PURPOSE OF THE CONTEST

- 3.1 To create an engineering project to encourage individuals with different skill sets to form c-operative teams to design, fabricate and operate a robot.
- 3.2 The intent of the challenge is to have teams of students independently designing / fabricating / operating robots capable of completing the competition tasks in competition with other student-fabricated robots. Teams are not allowed to develop or implement strategies based on interfering with their opponent's ability to complete the competition task set.
- 3.3 Builder Bots Tournament Standing will be based on total number of Points Scored in all games played by each team.

### 4.0 SKILLS AND KNOWLEDGE TO BE TESTED

- 4.1 Drafting
- 4.2 Mechanics
- 4.3 Electronics
- 4.4 Computer Programming
- 4.5 Metalwork
- 4.6 Woodworking
- 4.7 Communications

## **5.0 EQUIPMENT AND MATERIALS**

### **5.1 SUPPLIED BY THE SKILLS ONTARIO TECHNICAL COMMITTEE**

- One worktable with access to a 120V (min. 100W) power outlet per team
- For the Tele-operated component: Exclusive Use Playing Fields for each Team's Game and Evaluated Robot Experiences
- For the Autonomous Component: Exclusive Use Playing Fields for each Team's Game and Evaluated Robot Experiences
- A portable Grinder and portable Jig Saw for use in the Safe Material Removal Work Space

### **5.2 SUPPLIED BY THE COMPETITORS AT A MINIMUM**

#### **For the Tele-operated Component:**

- Easily accessible fuses on their robot
- Easily accessible kill switch(es) on their robot
- Robot accessories including batteries, controller(s), battery charger, spare parts
- Table top robot stand
- Tool box including the various tools required to modify and repair robots on-site
- Safety equipment including mandatory eye protection
- Power Bar / extension cord
- Completed Pre-inspection Checklist
- Robot Wiring Diagram

#### **For the Autonomous Component:**

- Lap Top Computer
- Microcontroller for Autonomous Task
- Microprocessor / Software (LEGO, VEX, Raspberry Pi. Etc.
- Teams will not be permitted to contact anyone outside the contest area or access files not saved to the desktop of the computer. Teams caught corresponding with those outside the contest area electronically or in person may be disqualified.
- Media devices, such as cell phones, smart phones, mp3 players or PDAs are not permitted on the contest site.
- Prior to attending the Skills Ontario Competition, students should be familiar and competent in the use of the tools and equipment listed above as well as what safety precautions will be observed during the Skills Ontario Competition.
- As always teams can use whatever components they wish, obtained from sources of their own choosing, when creating their Tele-operation or Autonomous Robot Solutions.

- Teams are responsible to provide their OWN components used to create their 2020 Skills Ontario Robotics Competition Built In-Advance at School Tele-operation and Autonomous Robots.
- Teams are permitted to use the platform of their choice for their Autonomous component (LEGO, VEX, Raspberry Pi, etc.)

## 6.0 SAFETY

Safety is a priority at the Skills Ontario Competition. At the discretion of the judges and technical chair, any competitor can be removed from the competition site for not having the proper safety equipment and / or not acting in a safe manner.

- It is mandatory for all competitors to wear CSA approved eyewear (including side shields for prescription eyewear) when doing any material removal fabrication work on the robots.
- Competition judges will have final authority on matters of safety.
- Competitors must show competence in the use of tools and / or equipment outlined in this scope and can be removed at the discretion of the judges and technical chair if He / She does not display tool and / or equipment competency.

## 7.0 CONTEST STATUS

- This contest is offered as an official team of 4 contest at the Skills Ontario Competition.
- This contest is offered as a team of 2 contest at the Skills Canada National Competition (SCNC2020 Vancouver).

**NOTE:** Given the National Robotics Competition involves Teams of TWO Competitors, immediately following the Closing Ceremony on May 6<sup>th</sup> teacher of the Ontario Gold Medal Team of 4 will be required to identify which two of their competitors will advance to 2020 Vancouver.

**NOTE:** 2020 IS a qualifying year for WorldSkills.

## 8.0 OTHER RULES AND REGULATIONS

Immediate disqualification may occur at the discretion of the technical chair if a competitor displays any of the following:

- Acts inappropriately
- Shows disregard for the safety of themselves or those around them
- Breaks the established rules and regulations including:
  - Uses equipment or material that is not permitted
  - Dishonest conducted (cheating, plagiarism)
  - Speaks with those outside the contest area
  - Arrives to the contest site area late

- Sign-in for all contests will happen on the contest site the morning of the competition.

## 9.0 CLOTHING REQUIREMENTS

- Competitors are to be dressed in a clean and appropriate manner.
- Competitors are not permitted to wear clothing with logos or printing.  
Note: The exception to this rule is the logo of the school, school board, college or MTCU District that the competitor is representing.
- ONLY the logo of the institution under which the space is registered can be visible.
- Corporate logos are not permitted on a competitor's clothing.

## 10.0 SKILLS ONTARIO COMPETITION AGENDA

Monday, May 4 <sup>TH</sup> – Tele-operated Tournament Play and Autonomous Tournament Play	
7:00am – 7:30am	Sign-in at the contest site
7:30am – 7:45am	Orientation
7:45am – 9:00am	On-court practice time (for both Tele-operated and Autonomous Components), Inspection for Tele-Operated Robots
9:00am – 12:00 Noon	Tele-Operated Tournament Games / and Autonomous Evaluated Experiences will be hosted simultaneously
12:00 Noon – 1:00pm	Lunch
1:00pm – 4:00pm	Tele-Operated Tournament Games / and Autonomous Evaluated Experiences will be hosted simultaneously
* 4:00pm – 4:30pm	*Open Courts for teams to practice
<p>To ensure all teams receive an equal number of Games / Evaluated Experiences this practice time may be reduced. All teams must be off the courts and out of the pit area by 4:30pm. Both Tele-operated and Autonomous Robots must remain in the Pit Area overnight.</p> <p>Competitors must be on time for their contest and may be disqualified if they do not sign-in at their contest site prior to the start of orientation. At the discretion of the technical committee chair, the competitor may be permitted to compete but would not receive any additional time.</p>	

<b>Tuesday, May 5<sup>TH</sup> – Tele-operated Tournament and Playoff Play / Autonomous Tournament Play</b>	
7:00am – 8:30am	Practice Time on Court
8:30am – 12:00 Noon	Tele-Operated Tournament Games / and Autonomous Evaluated Experiences will be hosted simultaneously
12:00 Noon – 1:00pm	Lunch
1:00pm – 4:00pm	Tele-Operated Playoff Games and Autonomous Evaluated Experiences will be hosted simultaneously
4:00pm – 4:30pm	Competition Space Shut Down

A more detailed schedule of what times each team will compete will be released each morning of the competition. Although it will not be intentionally scheduled this way, teams may be required to compete on both the Autonomous and Tele-operated courts at the same time.

<b>Wednesday, May 6<sup>TH</sup> – Closing Ceremony</b>	
9:00am – 11:30am	Closing Ceremony
12:00pm – 1:00pm	Team Ontario Meeting
<p>A minimum score of <b>60%</b> will be required to receive any medal or to be eligible to advance to the Skills Canada National Competition.</p> <p><b>Contest Location:</b> Toronto Congress Centre, 650 Dixon Road, Toronto.</p> <p><b>Closing Ceremony Location:</b> Toronto Congress Center North Building, 650 Dixon Road, Toronto.</p> <p>Each competitor will receive <u>one</u> wristband at the contest orientation. This wristband identifies competitors as such and will also be used as the competitor's closing ceremony ticket. Competitors must ensure that the wristband remains on his/her wrist from the beginning of the competition until after the closing ceremony.</p>	

## 11.0 JUDGING CRITERIA

- 11.1 Teleoperated Robot Tournament = 30%
- 11.2 Teleoperated Robot Playoffs = 30%
- 11.3 Autonomous Robot Tournament = 40%
- 11.4 There are two components to the 2020 Robotics Contest
  - Teleoperated Robot Component – This is the traditional contest that has been seen over the past at the Skills Ontario Competition. It is permitted to have both teleoperated and



- autonomous elements used in this component.
- Autonomous Component – Teams will build a second separate Robot to be tested on a different court and which will be 100% Autonomous.

### 11.5 Judging Criteria: Total 100 Marks

#### 11.6 Teleoperated Builder Bots Tournament Play = 30 Marks

- Highest Scoring Teleoperated Builder Bots Tournament Team = 30 Marks
- All Other Teams awarded Teleoperated Builder Bots Tournament Marks based on the following formula:
  - $(30) \text{ (Individual Team Total Score / Highest Team Total Score)}$
- The TOP 16 Teams based on Final Builder Bots Tournament Play Results advance to the Teleoperated Builder Bots Playoffs

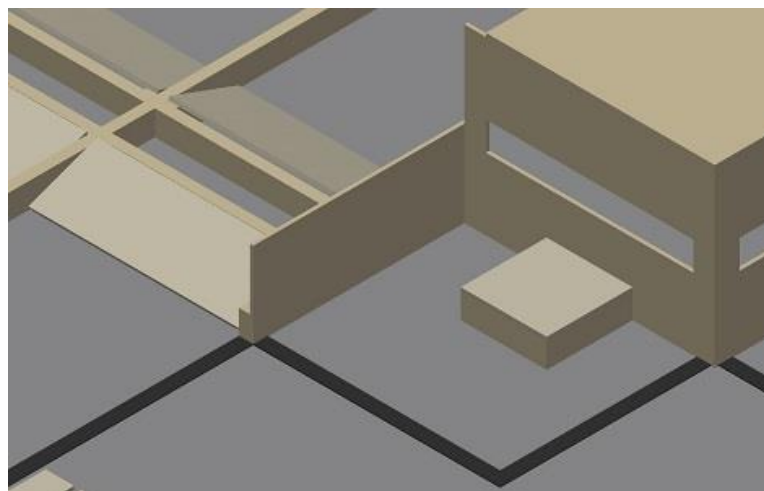
#### 11.7 Teleoperated Builder Bots Playoff Play = 30 Marks

- 6 marks per Ladder 'A' Bracket Playoff Game Win
- 4 marks per Ladder 'B' Bracket Playoff Game Win

#### 11.8 100% Autonomous Tournament Results = 40 Marks

- Highest Scoring 100% Autonomous Tournament Team = 40 Marks
- All Other Teams awarded Autonomous Tournament Marks based on the following formula:
  - $(40) \text{ (Individual Team Total Score / Highest Team Total Score)}$  so if you scored half the points compared to the winning Team you will get 20.0 Marks.
- There will be NO Playoffs in the Autonomous Competition. Final standing will be based on the total points scored in ALL Evaluated Task Runs of a Team over the two competition days.

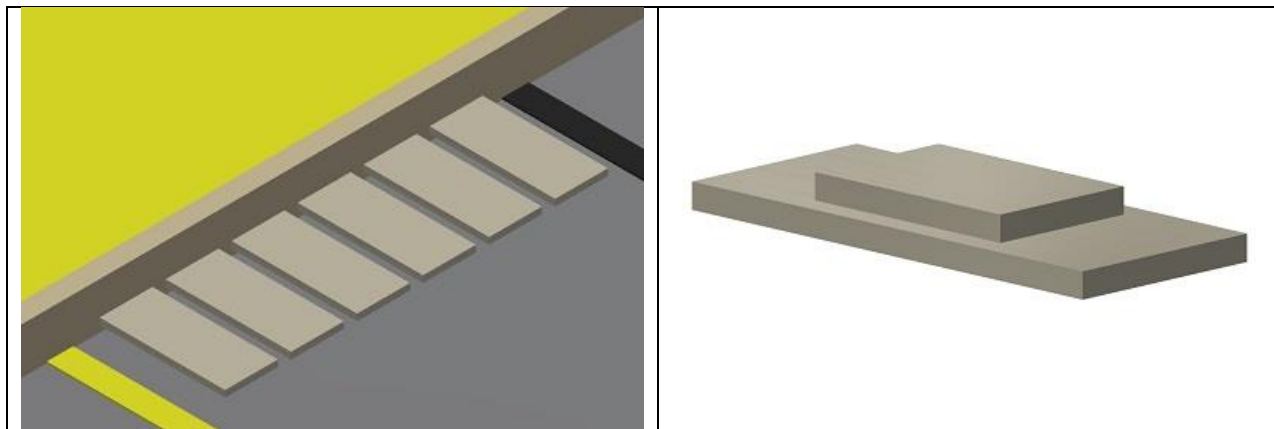
## 12.0 THE BUILDER BOT(S) GAME OVERVIEW



12.1 The core game situation requires a Robot or Robots to use the components provided in their Exclusive Use Court Space to (a) Complete the building of the Bridge by putting the Road Surface Boards in place and (b) to Build the Totem Pole ON the Designated Stand or ON the Floor In the Assigned Robot Assembly Area.

## BRIDGE FRAMEWORK AND ASSIGNED ROBOT ASSEMBLY AREA

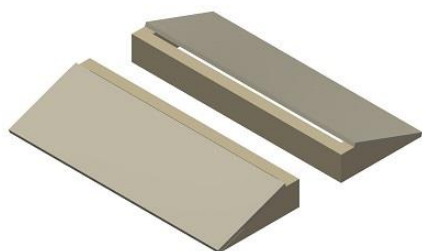
### 13.0 THE BRIDGE



#### 13.1 Teams have use of SIX Bridge Plates:

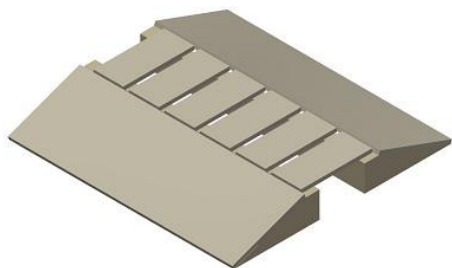
(a) Each Bridge Plate is 9.5 by 4.0 by 0.5 in. and has a 4.5 by 3.0 by 0.5 in. Plate attached to the Bottom Side of the Bridge Plate.

(b) At the start of the game the SIX Bridge Plates are sitting on the court floor along the Back Wall of each Team's Home Area.



#### 13.2 Each Bridge Structure provides:

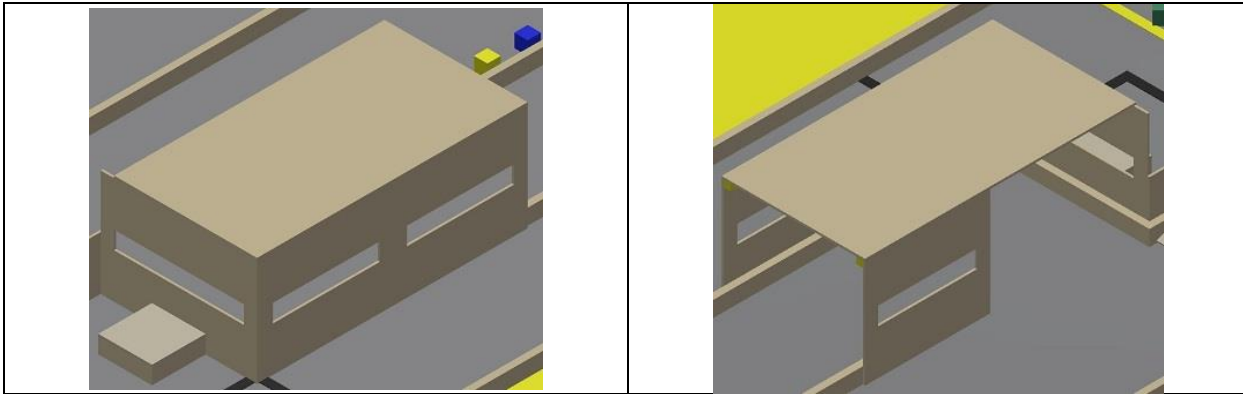
- (a) A 20 Degree Entry and Exit Ramp
- (b) A 6-Inch-Wide Open Gap between the Two Ramp Structures
- (c) Two Beams able to support the Bridge Roadway Plates



#### 13.3 A Fully Built Bridge has:

- (a) SIX 9.5 by 4.0 by 0.5 in. Bridge Roadway Plates
- (b) Plates MUST be installed Right Side Up

## 14.0 THE PASSAGEWAY TUNNEL



14.1 A Tunnel Structure placed in the Passageway area will restrict competitor's view of their robot at times.

14.2 The Dimension Details of the Tunnel are provided in the Appendix Section of this document.

## 14.1 BASE BLOCK

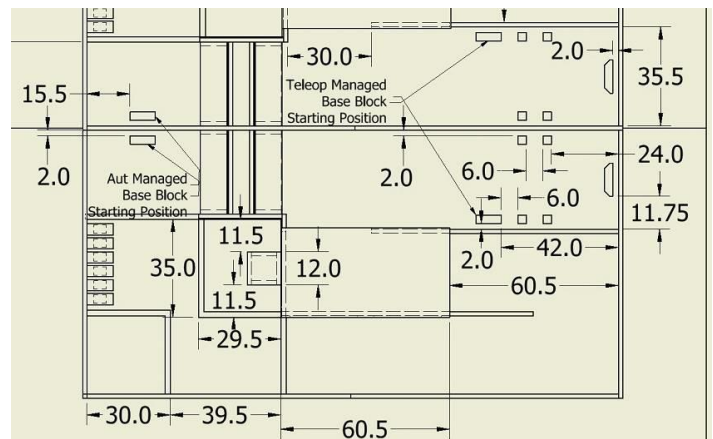
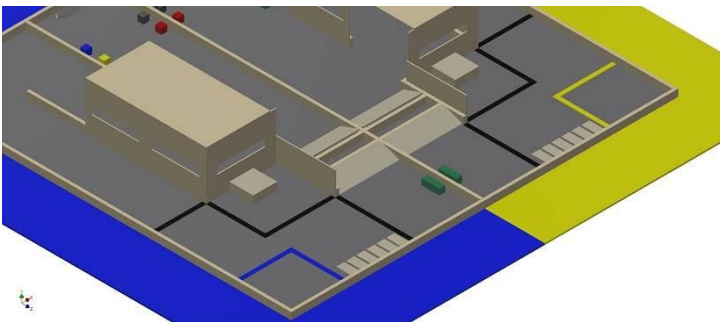
The Base Block will be placed 2 inches away from the center wall in the same manner as all of the Totem Pole Blocks.

"I have made all the pieces out of foam and duct tape. They are very very light even with the tape.

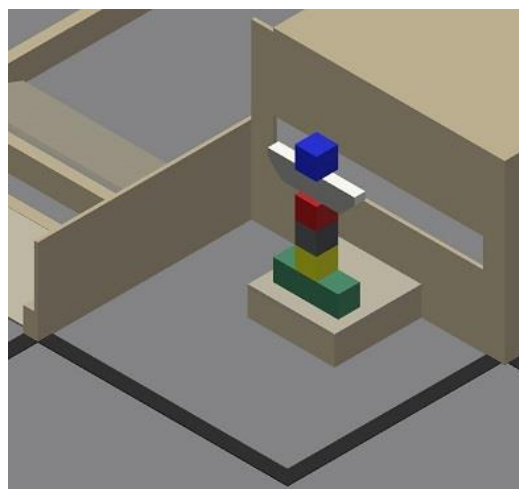
Base Block = 54 grams

Totem Pole Cube Blocks = 18 grams

As a point of comparison, a fat sharpie marker is 18 grams so same as a Totem Pole Cube Block.



## 15.0 TOTEM POLES



### 15.1 Building Totem Poles involves:

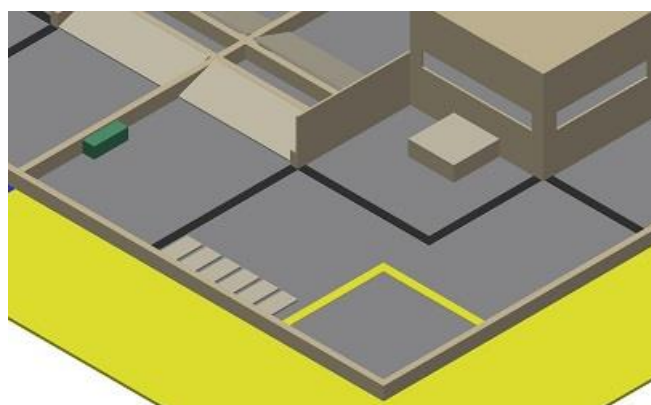
- Build it on the 12 by 12 by 4 in. Stand, or, build it on the Court Floor Inside the Designated Assembly Area
- Use ALL SIX of the available Totem Pole Components
  - A 9.0 by 3.0 by 3.0 in. Base Block
  - FOUR 3.0 by 3.0 by 3.0 in. Core Blocks
  - A 12 by 3.5 by 1.5 in. Wing Block
- Robots must be in their Assigned Home Area when building a Totem Pole.
- Robots cannot reach over or through a passageway wall to deliver a Totem Pole Component into the assembly area.



### 15.2 A Complete Totem Pole has SIX Levels

- Bonus Points are awarded when the Wing Block is positioned on its' 1.5 in Narrow Face
- Bonus Points** are awarded when a Core Block is positioned on the 1.5 in. Wide Top Edge of a Wing Block

Note: A Block placed on a Block that is on the Narrow Edge of the Wing Block will also be awarded the Bonus Points.



15.3 Teams will be awarded Bonus Points if they move the Totem Pole Base Component into position using an Autonomous Robot Element of their overall Team Entry.

**Note:** Robot's attempting this autonomous task will NOT start in possession of the Totem Pole Base Component. The Base Block will be placed Outside the Team's Home Area.

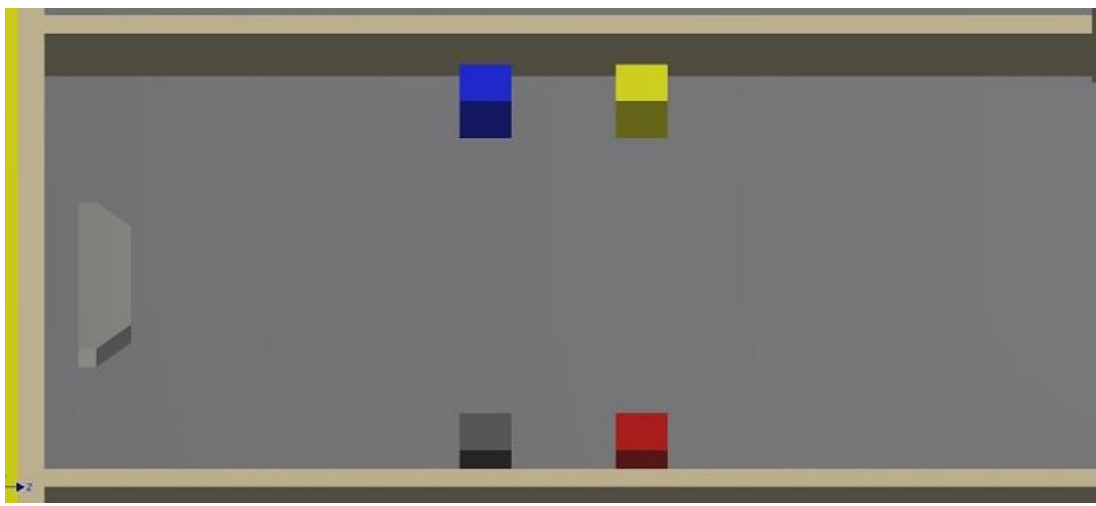
**Note:** At the start of a game, the Totem Pole Base Component will be placed in the Components Source Area for Teams deciding to move it into the Assembly Area using their Tele-operated Robot.

## 16.0 THE TOTEM POLE COMPONENTS

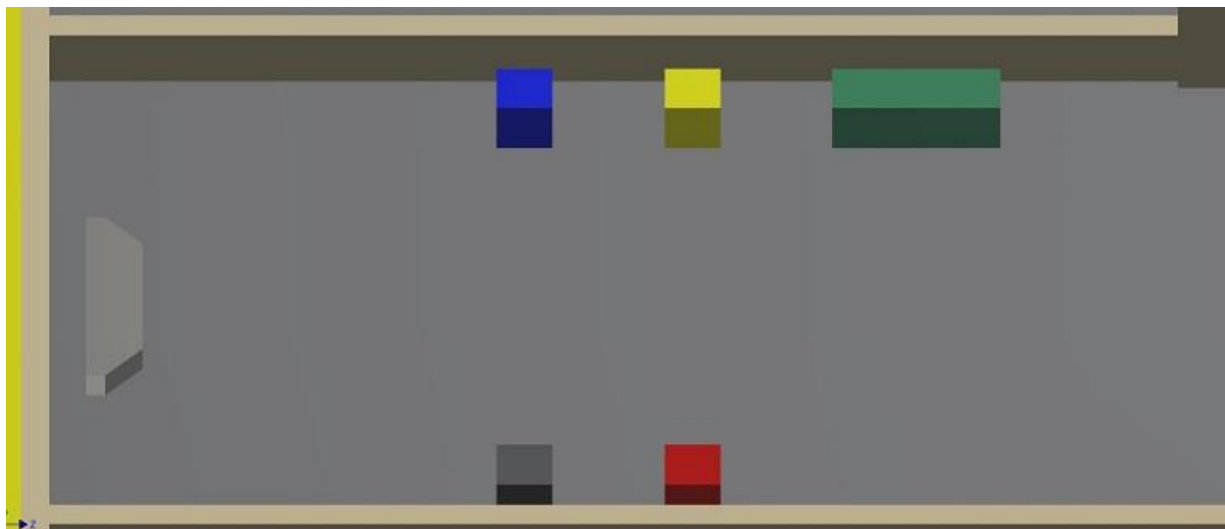


- a) Made by gluing together pieces of 1.5 In. Thick Rigid Foam Blocks, and,
- b) Will be wrapped with colored Duck-Tape.

## 17.0 TOTEM POLE COMPONENTS SOURCE AREA

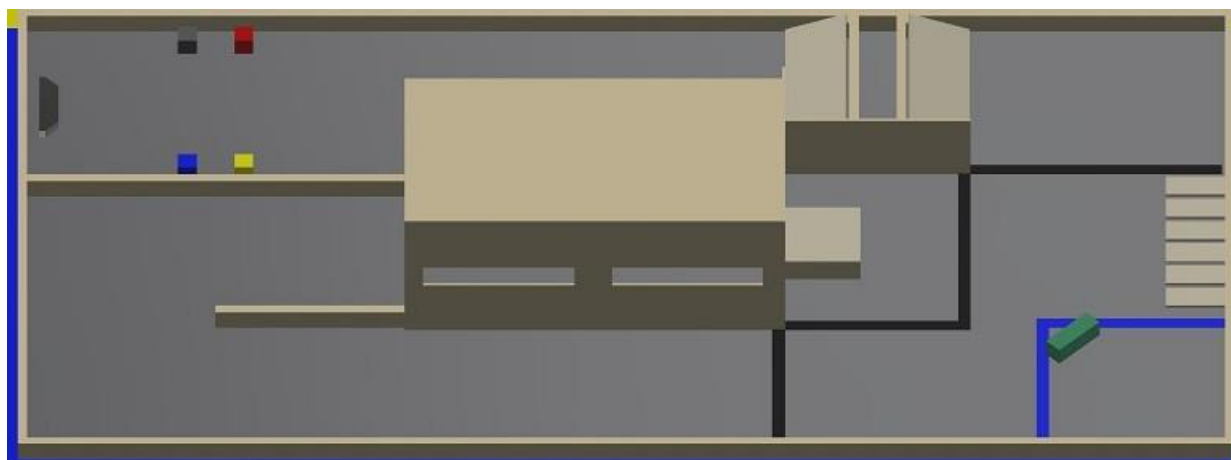


17.1 At the Start of a Game the Teams that are Managing the Totem Pole Base Component Autonomously will have the Totem Pole Base Component in the their Autonomous Robot's Possession. The remainder of the Totem Pole Components will be in the Team's Exclusive Use Components Source Area in the Positions shown above.



- 17.2 At the Start of a Game the Teams that are using Teleoperation to Manage the Totem Pole Base Component will have the Totem Pole Base Component in the Team's Exclusive Use Components Source Area in the Positions shown above.

## 18.0 ROBOT TRAVEL OPTIONS



- 18.1 Teams have Two Travel Options for moving between the Totem Pole Assembly Area and the Exclusive Use Components Source Area.

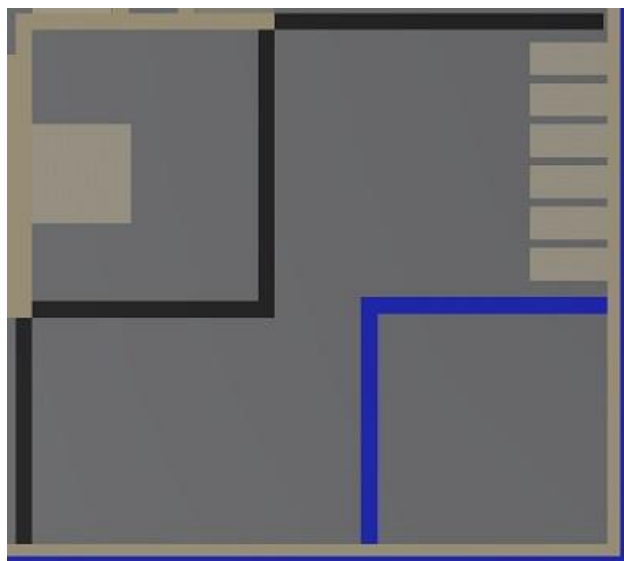
**Option One:** Travel along a Smooth set of Passageways and through the Tunnel, or,  
**Option Two:** Build and Travel Over the Bridge directly to the Exclusive Use Components Area.



## 19.0 EACH TEAM'S EXCLUSIVE USE AREA IS APPROXIMATELY 8 FT. BY 16 FT.

- 19.1 Teams have Exclusive Use of 30 in. wide passageway along three sides of their assigned court area.
- 19.2 Both Team Members can be active in and move throughout this entire team passageway space during game play.
- 19.3 It is a Team Responsibility to define the tasks assigned to each competitor.
- 19.4 If a Team has a Two Robot Entry, then:
  - a) Both competitors can be Robot Drivers
  - b) Both competitors can also be Spotters for their partner driver
- 19.5 If a Team has a One Robot Entry, then:
  - a) One Competitor can be the Robot Driver, and,
  - b) One Competitor can be the Spotter.

## 20.0 EACH TEAM'S HOME AREA INCLUDES



- 20.1 A Starting Square (Blue Tape Lines) and Each Team's Complete Robot Entry MUST fit onto the 30 by 30 Inch Starting Square defined by Outside Edge of the Tape Lines and the Corner Court Walls.
- 20.2 A Totem Pole Assembly Area defined by Black Tape Lines, one Tunnel Wall and the Side of the Bridge Wall with a Fixed in Position 12 by 12 by 4 in. Assembly Stand included in this space.
- 20.3 A Row of Six Bridge Plates positioned along the Court Wall.

- 20.4 Robot's will be deemed to be 'In their Home Area' when the all of the Robot's wheels or tracks are past either of the two tape lines that define the two entrances to the Home Area.

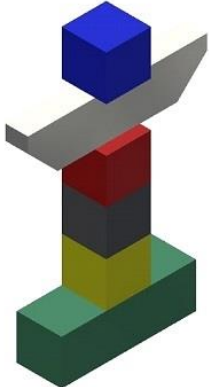
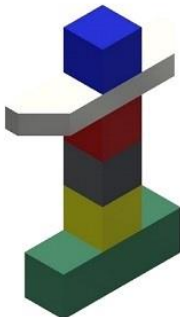
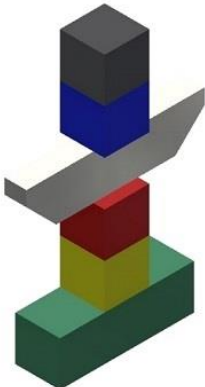
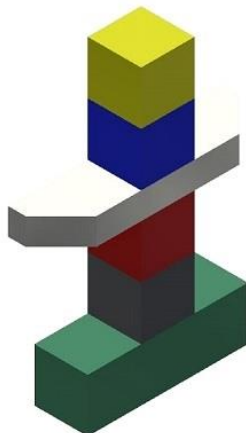
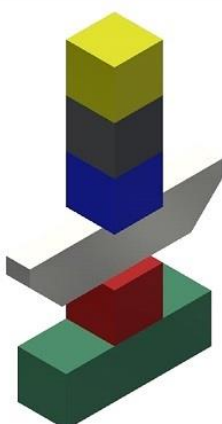
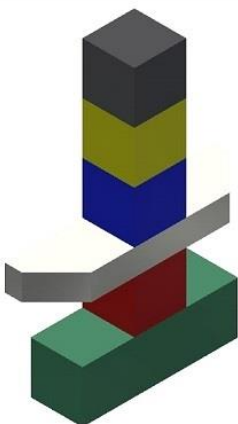
## 21.0 BUILDER BOT(S) GAME DESCRIPTION

- 21.1 Games will involve Two Teams at a time.
- 21.2 Both Competitors are allowed unrestricted movement around the perimeter of their Team's Assigned Court Area.
- 21.3 Teams can utilize a Maximum of TWO Tele-operated Robots.
- 21.4 Teams may also have one Independent Autonomous Element as part of their entry (which

must fit into the overall size limitation at the beginning of the game).

21.5 Teleoperated Robots may NOT be in possession of any Bridge Plates at the Start of a game.

**Note:** Competitors will participate in BOTH the Builder Bot(s) Game and the Autonomous Robot Golf Game during BOTH Competition Days.

Totem Pole Scoring Options	
Wings On Narrow Edge	Wings On Wide Side
	
	
	



The six Totem Poles shown represent samples of 'Complete Totem Poles' however, Teams will be awarded points for Partially Built Totem Poles with components (Blocks) positioned IN any pattern as long as they are on top of the Base Block.

## 22 SCORING SUMMARY

- 22.1 Scoring will be done at the end of each 4-minute game.
- 22.2 **TWO** Points will be awarded for each Bridge Roadway Plate correctly put into position on the Bridge Framework Structure.
- 22.3 **ONE** Point will be awarded for delivering the Base Totem Pole Block onto the floor in the Totem Pole Assembly Area.
- 22.4 **TWO** Points will be awarded for delivering the Base Totem Pole Block on to the Stand in the Totem Pole Assembly Area.
- 22.5 **ONE** Point will be awarded for **EACH** Core Totem Pole or Wing Block delivered onto the floor in the Totem Pole Assembly Area.
- 22.6 **TWO** Points will be awarded for **EACH** Core Totem Pole or Wing Block delivered onto the Stand in the Totem Pole Assembly Area
- 22.7 **ZERO** Assembly Points will be awarded for the Base Block.

**Note:** The points awarded based on the Layer a Block is placed in a Totem Pole are displayed in the Robot Marking Sheet Sample. Marks assigned increase by **ONE point per layer** as you move up the Totem Pole Structure.

- Totem Poles built on the Floor have a lower overall points value than Totem Poles built on the provided Stand given each component in an 'On the Floor Totem Pole' carries a Delivery Value of One Point while each component in an 'On the Stand Totem Pole' carries a Delivery Value of Two Points.

- Wing Blocks positioned on their Narrow Side will be awarded Bonus points.

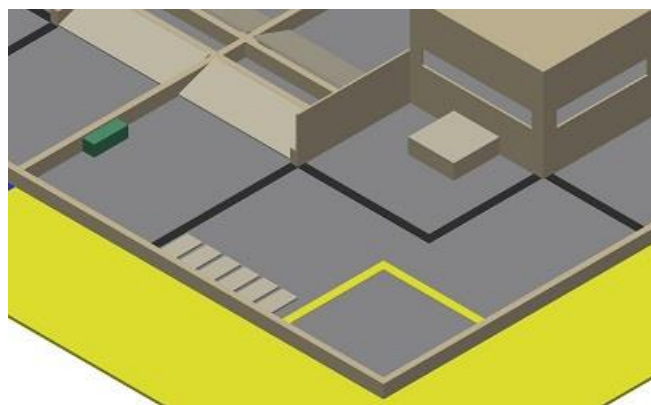
**Note:** Bonus points will be awarded for Core Blocks positioned on the Narrow Side of a Wings Block or On a Block that is On the Narrow Side of a Wings Block.

**Note:** Robots may possess a **Maximum of ONE Totem Pole Component** at a time.

However, there is **NO RESTRICTION** on the Number of Bridge Roadway Plates that a Robot may possess at a single time during a game.

2020 Skills Canada Ontario Robotics Build a Bridge and a Totem Pole Scoring Sheet													
Bridge Plates		Plate 1	Plate 2	Plate 3	Plate 4	Plate 5	Plate 6						
Bridge Plate Points Awarded 4 Points per Bridge Plate													
		Delivered by Aut Bot	Delivered by Telop Bot		Bridge Building Points Total MAX Score 24								
Totem Pole Components	Base Block	Base Block	Core Block 1	Core Block 2	Core Block 3	Wings Block	Core Block 4						
Component Delivery to Assembly Space	On Floor	On Stand	On Floor	On Stand	On Floor	On Stand	On Floor	On Stand	On Floor	On Stand	On Floor	On Stand	
Points Value	3	6	1	2	1	2	1	2	1	2	1	2	
Points Awarded													
Totem Pole Components Delivery Points Total MAX Score 16													
												BONUS	
Component Position In a Totem Pole Assembly	Base Block On Level 1	Base Block On Level 1	Core Block or Wings On Level 2	Core Block or Wings On Level 3	Core Block or Wings On Level 4	Core Block or Wings On Level 5	Core Block or Wings On Level 6	Wings On Narrow Edge	Block On Narrow Wing Edge				
Points Value	0	0	2	3	4	5	6	2	2				
Points Awarded													
Totem Pole Build Points Total													
Total Game Score													
Team Name:				Competitor Signature:									

## 23.0 TOTEM POLE BASE BLOCK DELIVERY



If an Autonomous Robot is used to deliver the Totem Pole Base Block then the following Game Situation Applies:

- a) The Base Block will be positioned along the Center Wall complete just outside the Team's Home Area.
- b) An Autonomous Robot delivering the Base Block to the Assembly Area Floor will be awarded 3 Points.
- c) An Autonomous Robot delivering the Base Block onto the Top Of the Stand in the Assembly Area will be awarded 6 Points.
- d) A Teleoperated Robot retrieving the Base Block from the Components Source Area delivering the Base Block to the Assembly Area Floor will be awarded 1 Point.
- e) A Teleoperated Robot retrieving the Base Block from the Components Source Area delivering the Base Block to the Top Of the Stand will be awarded 2 Points.

## 24.0 PIT AREA AND COURT ACCESS

- 24.1 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).
- 24.2 Teams **MUST** bring their Robots into the skill area at Orientation. Teams are **NOT** allowed to remove their robots from the skill area during the over-night periods between Orientation Day, Competition Day 1, and Competition Day 2 of the contest.
- 24.3 Laptops may be removed overnight by competitors.

## 25.0 TOURNAMENT PLAY

- 25.1 Teams will participate in a Tournament leading to a Seeded Double Elimination Playoff Tournament
- 25.2 Builder Bot Tournament Standing will be based on the total number of points scored in all games played by each team.

- 25.3 Teams will play in an equal number of Tournament Games.
- 25.4 The TOP 16 Teams based on Final Tournament Standing will advance to the Double Elimination Playoff Round of Games
- 25.5 Tournament games will last 4 minutes
- 25.6 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.
- 25.7 Between tournament games, battery changes and repairs to robots may be completed at the team's assigned Pit Area Worktable.
- 25.8 During game play, referees will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.
- 25.9 Damaging the court area is prohibited. If a robot's design causes damage to the 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.

- 25.10 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. Competitors cannot enter onto the court surface or make adjustments to their robot during a game.
- 25.11 If a robot is mal-functioning and represents a hazard to participants, other robots or itself in the opinion of the Referee, then, the referee 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.
- 25.12 It is a Team Decision what roles team members will fill. Drivers are the competitors holding the robot controller(s) and asserting direct control over a Tele-operated robot(s).
- 25.13 The Spotter would be the competitor providing navigational guidance to the driver.
- 25.14 Competitors may change roles while a game is in progress.
- 25.15 Competitors (Drivers/ and /or Spotters) can move freely in their Assigned Courtside Team Area throughout the game.
- 25.16 Competitors may **not** enter an opponent team's Assigned Courtside Team Area at any time during game play.
- 25.17 At the start of a game, robots are expected to be in their Designated Home Area Starting Square Starting Positions.
- 25.18 Robots arriving AFTER a game has started will be allowed to place their Robot in their designated Starting Position and use the Time remaining in the 4 minute game.
- 25.19 Robots must not leave the contest court at any time during a game.
- 25.20 It will be a referee's ruling that decides if an 'End of the Totem Pole Block Placement' was completed before or after the game-ending buzzer sounded.

- 25.21 If a Totem Pole Component lands out of the court, it may not be retrieved and will be out of limits of play.
- 25.22 Scoring will take place after the End of the Game Buzzer

## 26.0 COURT LAYOUT

- 26.1 Please note: Although great pains will be made to keep the court in compliance with the drawings, some inaccuracies in construction may occur. **Please make your robot designs allowing for a possible ½ inch tolerance.**
- 26.2 The primary court items that have a direct bearing on robot design are:
- The open court surface will consist of the good side of Plywood Sheets **OR** the facility floor **OR** the smooth side of Masonite Sheeting.
  - The Bridge Ramps and Bridge Plates are unpainted Plywood
  - Detailed court information has been included in the Appendix Section of this document.

## 27.0 THE ROBOT RESTRICTIONS

- 27.1 All elements of a team's entry, both autonomous and tele-operated 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.
- 27.2 Robots must remain in compliance with these rules throughout the competition.
- 27.3 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 non-compliance problem.

## 28.0 START OF THE GAME ROBOT STATUS

- 28.1 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:
- Robots must be stationary
  - Robots must be in their designated Home Area Starting Square Location.
  - If Team Entries involve multiple Robots / Mechanisms, then all of them must be placed in the designated starting location and must be positioned to not exceed the allowed total 4 cubic feet volume per Team.
  - All systems may be ON.
  - Air System Circuits may be fully charged to 100 PSI and their compressors can be ON.

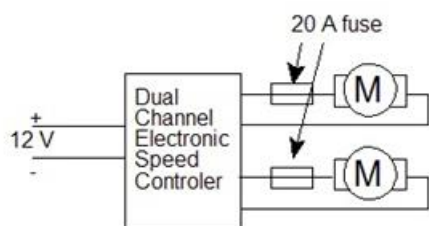
## 29.0 OVERALL TEAM ROBOT ENTRY SIZE

- 29.1 Complete Team Entries must fit within the 30 by 30 inch starting square at the start of each game.
- 29.2 Team Entries may expand to a larger size once a game has started.

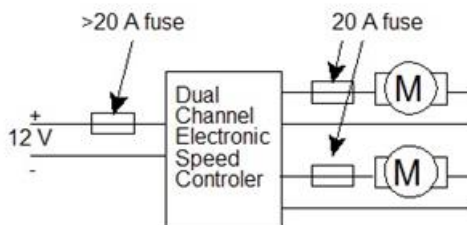
## 30.0 POWER SOURCES / MANAGEMENT

- 30.1 The total voltage in any individual circuit cannot exceed 24 volts
- 30.2 The maximum continuous power rating allowed in any circuit branch is 240 W, which will be limited by voltage and fuse selection. A larger main fuse can be used to provide protection for motor controllers. To calculate power in any given circuit, use the following formula: Power (Watts) = Voltage (Volts) x Current (Amps).

**Acceptable Circuit Protection: (ESC is NOT protected by fuse)**



**Recommended Circuit Protection: (ESC IS protected by fuse)**



- 30.3 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.
- 30.4 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.
- 30.5 Batteries must be complete sealed commercial battery packs.
- 30.6 All robots must be able to be turned off with a single motion.
- 30.7 Robot Controller receivers may be in an independent circuit.



## 31.0 NON-ELECTRICAL (BATTERY) ENERGY SOURCES

- 31.1 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.
- 31.2 Air pressure systems using Competitor-made or modified air pressure hardware are **NOT** permitted.
- 31.3 All pressurized tanks on robots must have a pressure gauge to indicate the stored pressure and a form of automatic overpressure safety relief system.
- 31.4 The pressure tanks and related gauges / controls must be shielded from damage due to collisions or flying target objects.
- 31.5 The stored pressure in the tank must not exceed a maximum of 100 PSI at any time.
- 31.6 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.

## 32.0 RECOMMENDED ROBOT CONTROLLERS

- 32.1 It is recommended (not required) that all teams use 2.4 GHz “non-crystal” control systems on Tele-operated Robots.
- 32.2 Teams are allowed the use of an unlimited amount of channels, but only two separate tele-operated robots. Teams assume full responsibility if any interference is to occur with their respective communication systems that could render the robot(s) useless.
- 32.3 Tele-operated 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.)

## 33.0 PIT AREA

- 33.1 Competitors **MUST** wear safety glasses when doing fabrication work involving material removal processes (grinding / cutting).
- 33.2 Only registered competitors are permitted in the contest space.
- 33.3 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.
- 33.4 Designated teacher/industry team advisors are **not** allowed in the pit area during tournament play.
- 33.5 Teachers and industry advisors are not permitted to handle tools or robot parts. Students must affect all repairs and modifications on their robot.
- 33.6 Teams will be provided with a pit area workspace on a standard project table.  
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.

#### 34.0 OVERALL COURT DESCRIPTION:

- 34.1 The Court Playing Surface will be a 16' by 16' square.
- 34.2 Individual Exclusive Use Team Spaces are 8' by 16' rectangles.
- 34.3 The Perimeter Court Walls will be made using 2 by 4 inch planks.
- 34.4 This wall will as a result be approximately 3.5 inches tall.
- 34.5 The court surface may vary between melamine, concrete, hardboard, or plywood.



## 35.0 PRE-INSPECTION FOR COMPLIANCE WITH SAFETY AND DESIGN RULES

- ☐ Mandatory Wiring Diagram provided.
- ☐ Tabletop Robot Stand
- ☐ Fits into the 30 by 30 Inch Starting Square
- ☐ Overall volume  $\leq 4 \text{ ft}^3$  or  $6,912 \text{ in}^3$
- ☐ No explosives/combustibles
- ☐ No lasers
- ☐ No Arial Robots
- ☐ 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 **branch** 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

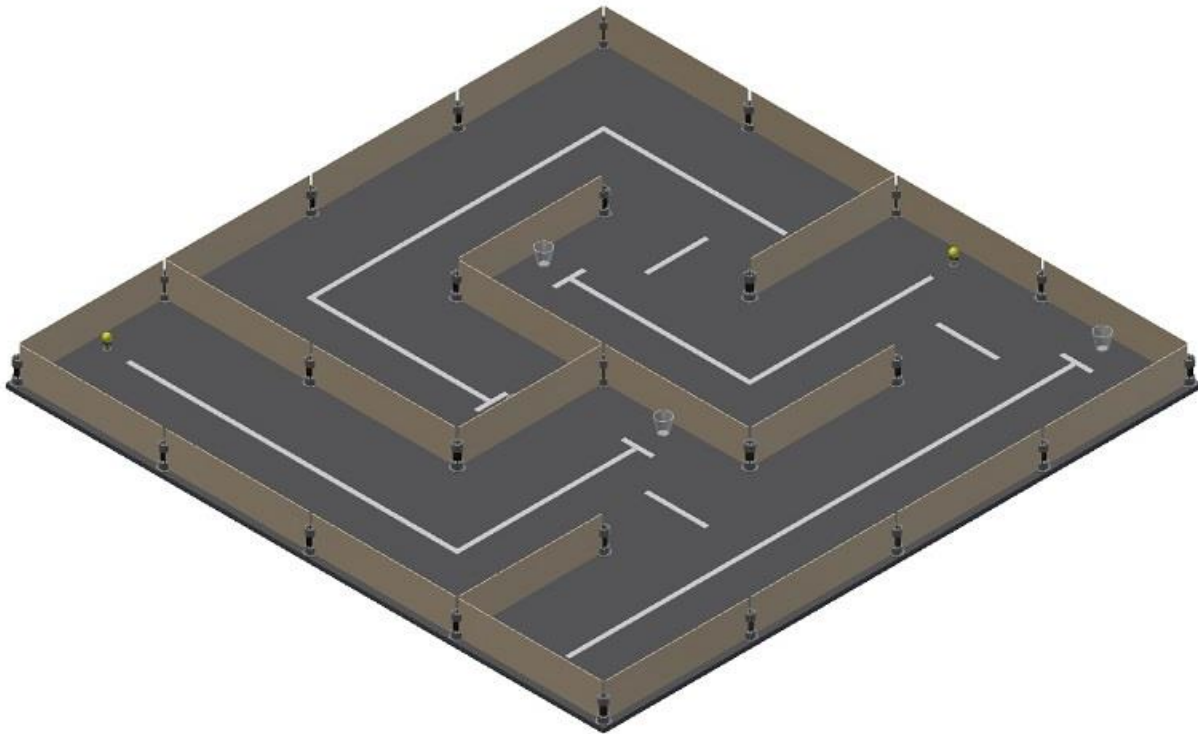
Additional concerns:

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Robot Evaluator Signature

Team Representative Signature

## 36.0 AUTONOMOUS GOLF COMPETITION - AUTONOMOUS PERFORMANCE REQUIREMENTS



### Competition Day One Golf Course

#### 36.1 Stage One Autonomous Robot Performance Requirements

- Start at the Mid-Point of the First Fairway with the Robot facing the First Tee
- The Robot needs to move to the First Tee and take Possession of the First Soft Golf Ball
- The Robot must move along the Fairway to the First Green
- The Robot must Deliver the Soft Golf Ball into the Cup on the First Green.

#### 36.2 Stage Two Autonomous Robot Performance Requirements

- Move to the Second Tee
- Take Possession of the Second Soft Golf Ball on the Tee
- The Robot must move along the Fairway to the Second Green
- The Robot must Deliver the Soft Golf Ball into the Cup on the Second Green.

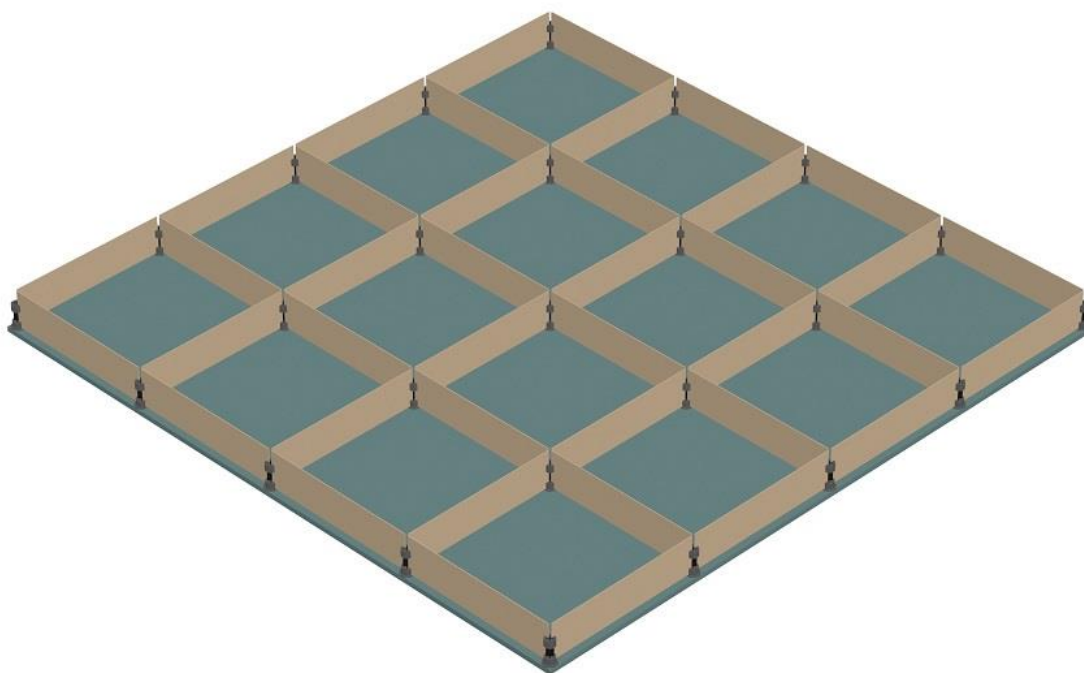
#### 36.3 Stage Three Autonomous Robot Performance Requirements

- Move to the Third Tee
- Take Possession of the Third Soft Golf Ball on the Tee
- The Robot must move along the Fairway to the Third Green
- The Robot must Deliver the Soft Golf Ball into the Cup on the Third Green.

#### 36.4 Stage Four Autonomous Robot Performance Requirements

- Move to the Fourth Tee
- Take Possession of the Fourth Soft Golf Ball on the Tee
- The Robot must move along the Fairway to the Fourth Green
- The Robot must Deliver the Soft Golf Ball into the Cup on the Fourth Green.

Competition Day Two Golf Course



36.5 The Competition Day Two Golf Course will be an 'Unknown In-Advance Layout' created by removing plates from the Grid shown above.



36.6 The Golf Courses for both Competition Days will be built using the Tetrix 'Competition In A Box'



36.7 The Golf Courses Elements (Tees and Holes) involve:

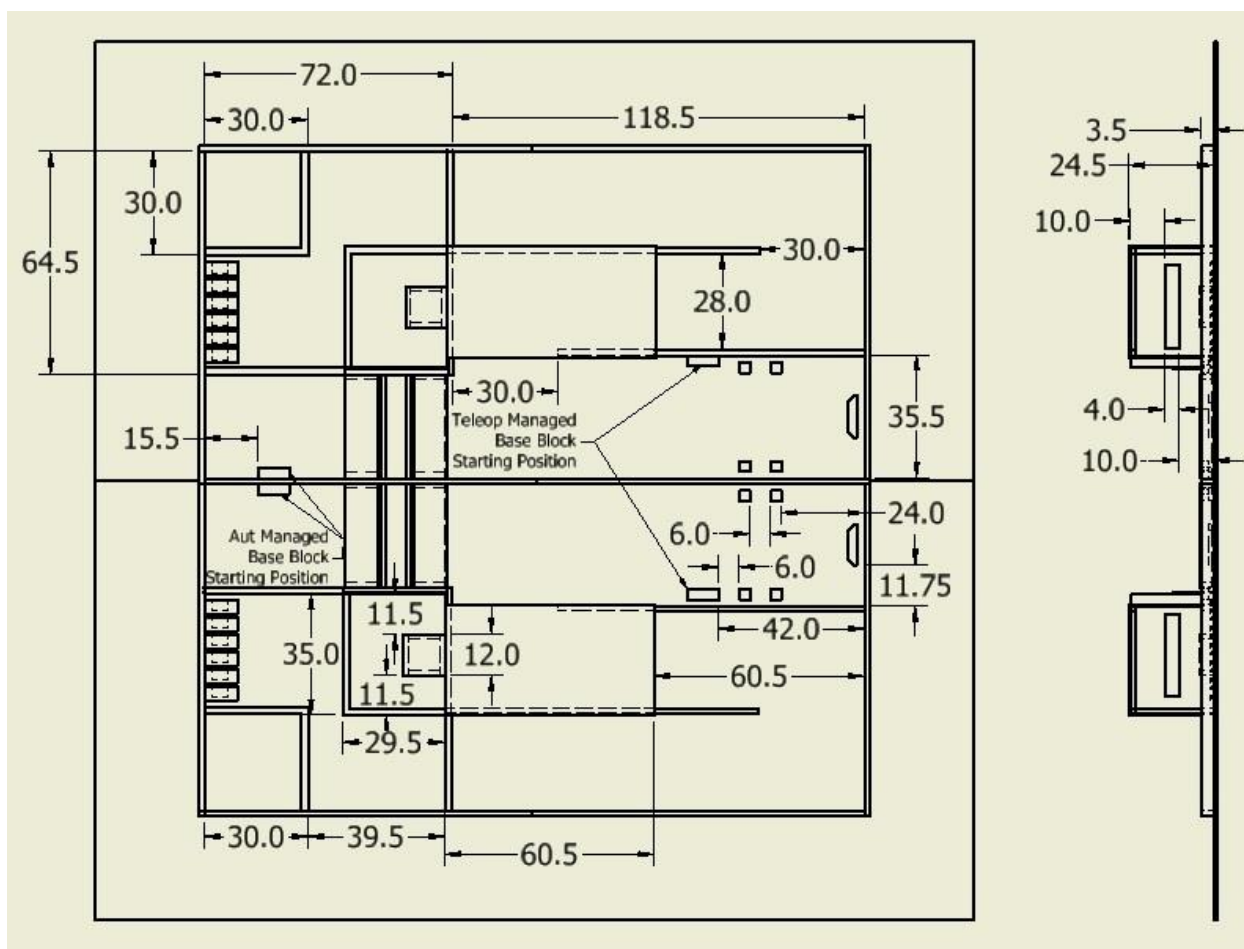
- a) Garden Hose Washers used to hold the Golf Balls in Position
- b) The Garden Hose Washer may be placed directly on the court floor, or, on top of a Spool.
- c) The Golf Holes are Plastic Cups
- d) The Golf Holes will have White Tape Lines leading to the Cup.

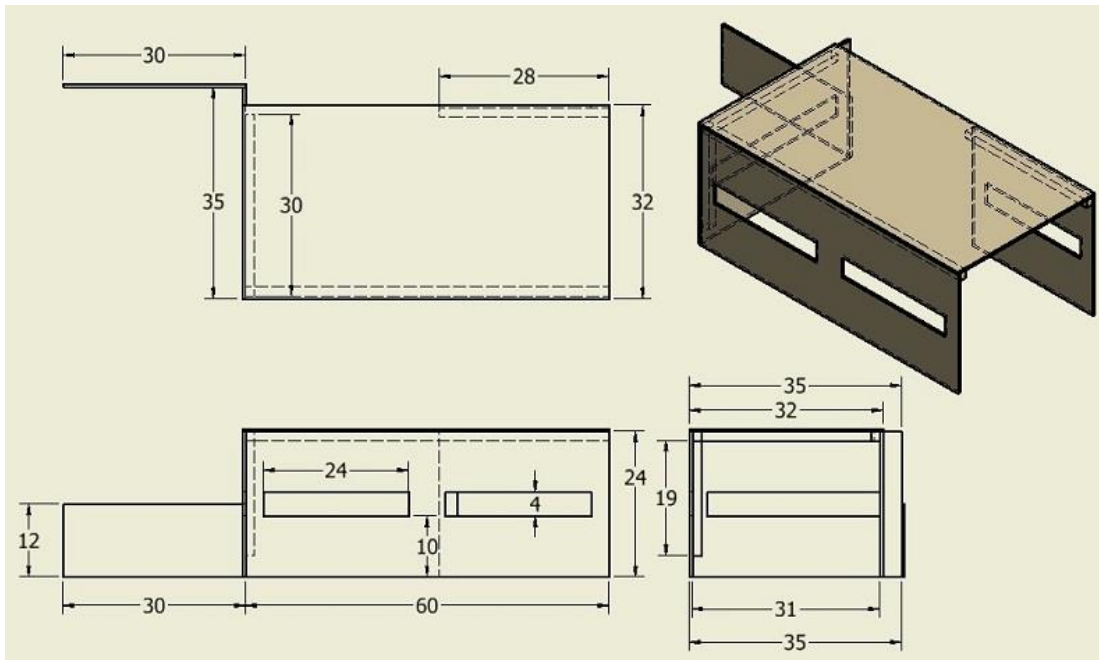
Note: The court floor is Grey Rubber Tiles.

Note: The court Perimeter Walls and Interior Dividers are Smooth Plates 5 Inches Tall.

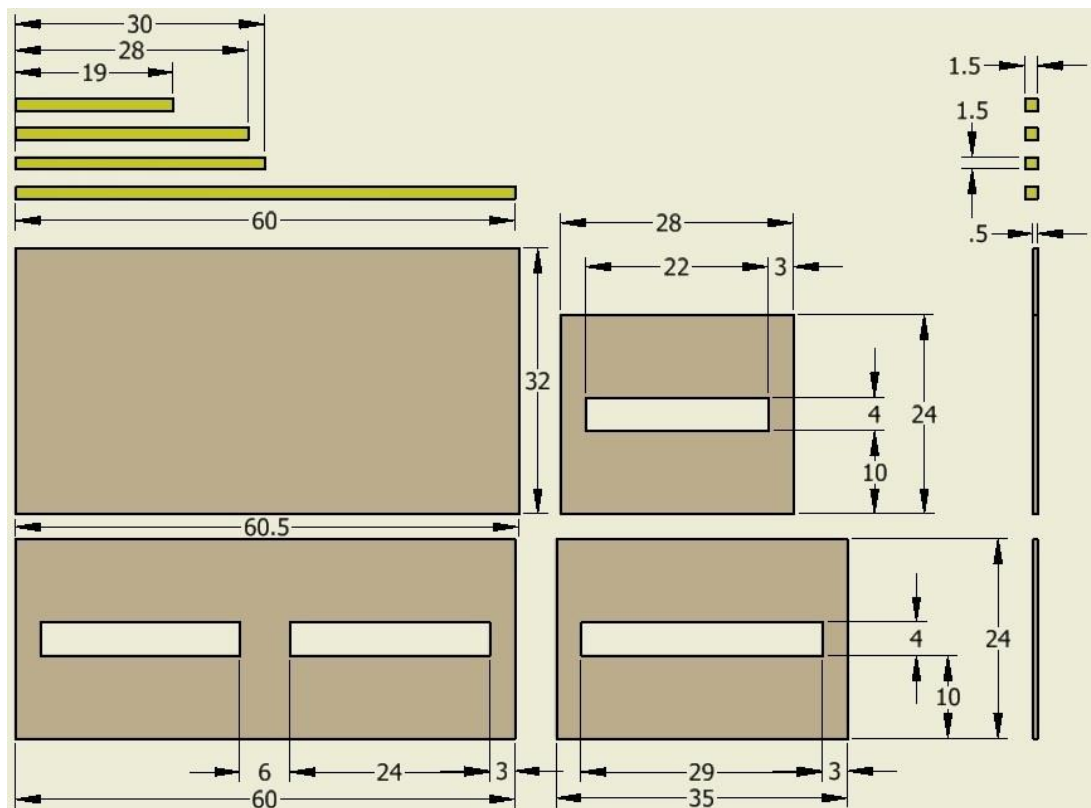
## APPENDIX

### 1.0 BUILDER BOT(S) COURT DETAILS





## 2.0 BUILDER BOT(S) TUNNEL DETAILS



### 3.0 BUILDER BOT(S) TUNNEL PARTS LIST

One: Long Side 60 by 24 by 0.5 in.  
One: End Wall 35 by 24 by 0.5 in.  
One: Short Side 28 by 24 0.5 in.  
One: Top 60 by 32 by 0.5 in.  
One: Top Rail 60 by 1.5 by 1.5 in.  
One: Shot Side Top Rail 28 by 1.5 by 1.5 in.  
One: End Wall Top Rail 30 by 1.5 by 1.5  
One: Corner Post 19 by 1.5 by 1.5

### 36.0 ADDITIONAL INFORMATION/ RENSEIGNEMENTS SUPPLÉMENTAIRES

- The Competition Information Guide can be found at:  
<http://www.skillsontario.com/competitions/secondary>
- Results for the Skills Ontario Competition Will be posted online starting Friday, May 17, 2020, at:  
<http://www.skillsontario.com/competitions/secondary>
- Information on the Conflict Resolution Procedure can be found on our website in the Competition Information Guide:  
<http://www.skillsontario.com/competitions/secondary>
- To receive feedback on your performance, you can e-mail [competitions@skillsontario.com](mailto:competitions@skillsontario.com).