BUILD:WIDGETS

INTRODUCTION

The BUILD: WIDGETS Robotics Challenge requires teams to design a LEGO robot that will help them gather elements, build widgets, and move them to their scoring locations. There are a total of 18 game elements available for each team to use to assemble widgets. A widget is defined as a combination of exactly 2, 3, 4, or 5 elements that are connected together, but not touching a robot. Game play includes a 30-second autonomous period and a 90-second driver-controlled period, where team members use Bluetooth devices to operate their robot as they complete a list of tasks to earn points. We've done the math, and there are a total of 12,597 unique combinations of game elements that teams might utilize as they take on the challenge.

The BUILD: WIDGETS Robotics Challenge consists of two components:

Documenting the Design Process
Teams will document the design, strategy, and building procedures of their robot as they prepare for competition day. Documentation will include daily handwritten notes, testing data, sketches and photos, sample code, and more. Documentation should be compiled in a way that illustrates the team's journey through the design process and demonstrates problem-solving and critical thinking. Teams will submit a design notebook on competition day that will be scored by referees. Teams must submit a design notebook in order to be allowed to participate in team gameplay. The Design Award will be given to the team with the best, most complete design notebook.

Team Game Play
BUILD: WIDGETS matches consist of a 30-second autonomous period followed by a 90-second driver-controlled period. During the 30-second autonomous period, robots will move on their own to accomplish predetermined tasks and earn points. At the end of the autonomous period, referees will pause the match and assess points before starting the 90-second driver-controlled period. During the driver-controlled period, teams will remotely control (via Bluetooth) their robot to accomplish tasks and earn points. At the end of the driver-controlled period, referees will again assess points and calculate the match scores.

Teams will play five (5) qualification matches with alliance partners. Team alliance partners for the five (5) qualification matches will be randomly assigned prior to the start of the competition. Alliance partners will work together to accomplish as many tasks and earn as many points as possible during the match. Points earned in each match will be shared equally between the two alliance partner teams. A team's scores from each of its five (5) qualification matches will be combined to get an overall team ranking score. At the conclusion of all qualification matches, the teams will be ranked from first through last based on their overall team ranking score.

Once the qualification matches are completed and all teams have an overall ranking score, the eight (8) highest ranked teams will select an alliance partner for the finals tournament. The alliance selection process allows the top teams to choose an alliance partner with whom they will compete in the single-elimination Finals Tournament in order to decide the BUILD: WIDGETS Robotics Challenge champion.

1. GENERAL RULES

Teams are composed of three to five students. Students are not allowed to participate on more than one team for this competition.

Teams must register under a team sponsor who holds an active TCEA membership. The team sponsor will be the primary contact and main source of communication leading up to competition day.

All teams are required to register for the BUILD: WIDGETS Robotics Challenge using a unique team name. Team names should meet common decency standards and be less than 20 characters.

Only registered team members are allowed to touch the robot and the computer used to program it. Student problem solving on the day of competition is central to the spirit of this robotics challenge.

Only registered team members will be allowed in the team's work area before, during and after the competition.

Sponsors and parents may help transport equipment before and after the competition, but they must not provide any assistance to students during the competition.

Teams must designate one (1) student member to be the team spokesperson. The team spokesperson is the only person on a team who can review and initial score sheets or dispute field setup or gameplay issues with the referees.

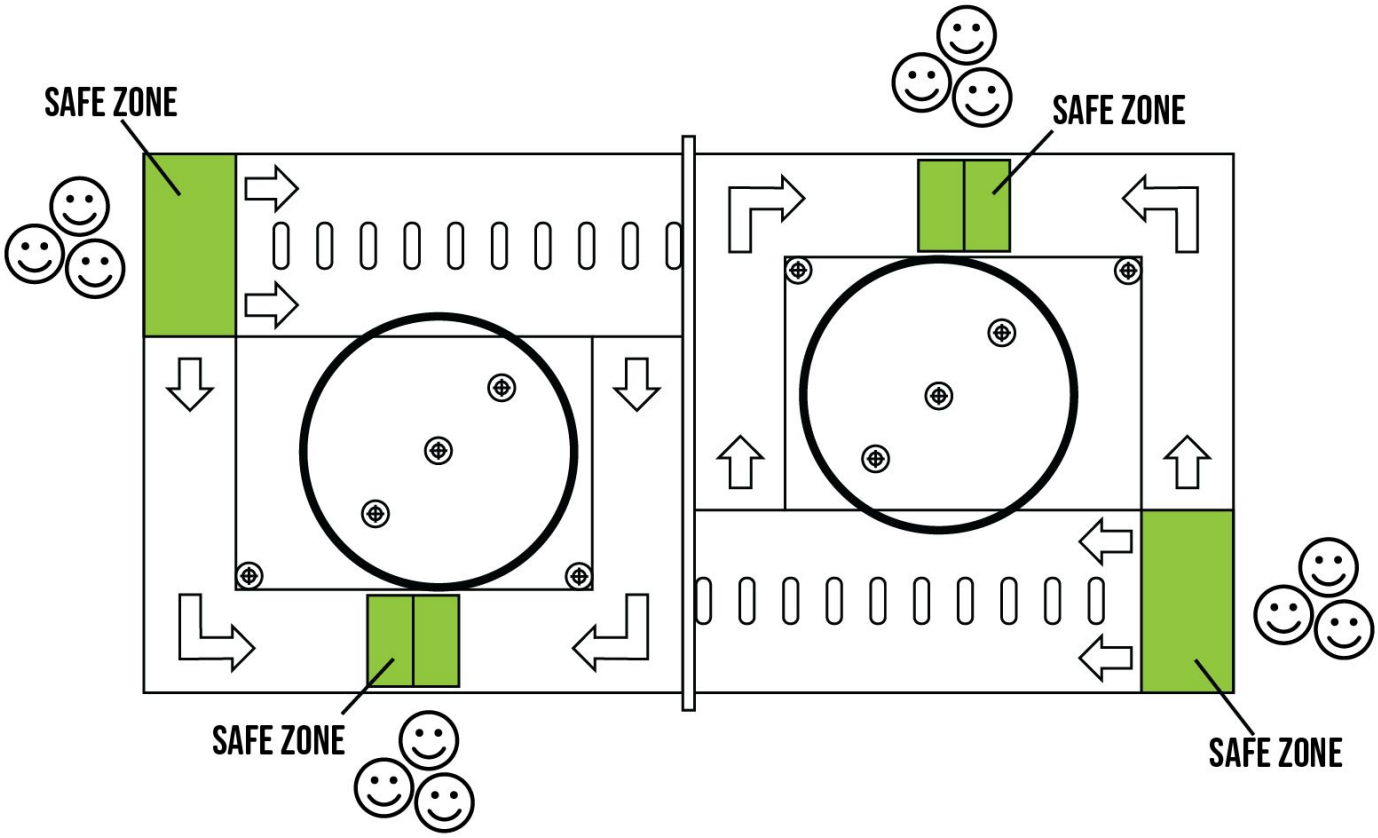
Team alliance captains teams must sign off on match scores/results at the end of each match. Teams are only allowed to contest match scores/results with the referee at the conclusion of the match, before leaving the playing field area.

Recording and streaming video of the match is allowed using team-provided mobile devices or cameras. Video playback is not allowed in the contesting of match scores/results.

Teams must be aware of the progress of the match schedule and be prepared to report to the correct playing field prior to their match. Teams are expected to be at the "on deck" area and report to the playing field when called.

2. PLAYING FIELD

The BUILD: WIDGETS Robotics Challenge will be played on the Race Against Time mat on a standard TCEA competition field. Teams will play with an alliance partner on one half of the table while two more teams play as another alliance on the other half. This means that four teams will compete simultaneously during a match, two teams per side. Each team will be stationed at one of the four Safe Zones around the playing field..



The Safe Zones are the only area of the playing field where students are allowed to touch robots or game elements. When a robot is touching a Safe Zone, team members may change and restart programs, reconfigure robot elements, and reposition or reorient the robot. If the robot is repositioned or reoriented, it must be still touching the Safe Zone before continuing with game play. When game elements are inside a Safe Zone, team members may pick them up, reconfigure them, and reposition or reorient them. If game elements are repositioned or reoriented, they must continue to be inside the Safe Zone before continuing with game play. For an object to be considered “inside a Safe Zone” the element must be completely inside the outer perimeter defining the Safe Zone.

There are two Safe Zones on each side of the playing field. The safe zones are slightly different in size and shape. Alliance teams will decide which team will use each Safe Zone prior to the start of each match. Teams must be prepared to play the game from either Safe Zone.

The other named features of the playing field are: the big circle, the small arrows, the right-angle arrows, the rounded rectangles and the small targets. These features will be used to position game elements and score points.

3. GAME ELEMENTS

There are a total of 18 game elements available for each team to use to build widgets. These game elements will be placed on the playing field by the referees prior to the beginning of each match. Some elements will be directly available to a team and some will be potentially available. These elements will be combined during gameplay to create widgets. A widget is defined as a group of exactly 2, 3, 4, or 5 elements that are touching each other, but not touching a robot.

LEGO Bricks
There are a total of four (4) LEGO 2x4 bricks available to each alliance to use to build widgets. These four bricks will be placed inside the right-angle arrow farthest from the center dividing wall. Inside means that all four bricks will be located completely inside the black line defining the outermost perimeter of the arrow. Because the area of the right-angle arrow is greater than the area of the four bricks, there will be some degree of randomness to the exact placement of the LEGO bricks within the arrow. The referees will determine the exact location of the bricks inside the arrow, and teams should expect that to vary each match.

Dollar Bill
There will be one (1) one-dollar bill available to each alliance to use to build widgets. The dollar bill will be placed inside the large circle by the referees prior to the start of the match. Inside means that the entire dollar bill will be located inside the thick black line defining the perimeter of the circle. Because the area of the circle is greater than the area of the dollar bill, there will be some degree of randomness to the exact placement of the dollar bill within the circle.

Switch Plate
There will be one (1) light switch plate available to each alliance to use to build widgets. The light switch plate will be placed on top of the short arrow located nearest the center dividing wall. The referees will place the switch plate on the arrow so that it covers the perimeter lines of the arrow. The light switch plate will be placed smooth side down.

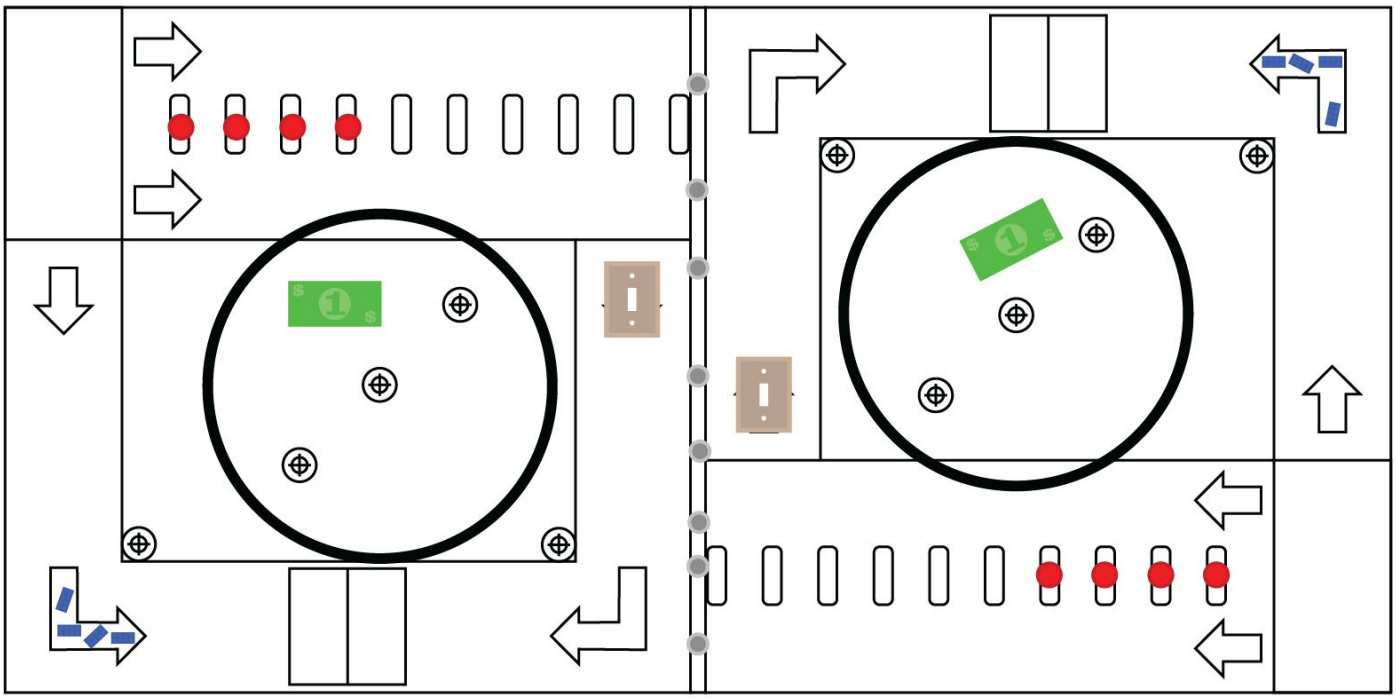
Red Checkers
There are a total of four (4) red checkers available to each alliance to use to build widgets. These four checkers will be placed on the four rounded rectangles farthest from the center dividing wall. The checkers will be centered horizontally and vertically on each of the rectangles.

PVC Couplers
There are a total of eight (8) PVC couplers available to each alliance to use to build widgets. These eight (8) PVC couplers will be placed along the top of the center dividing wall. Because the length of the center dividing wall is longer than the width of the eight (8) PVC couplers, there will be some degree of randomness to the exact placement of each coupler along the top of the center dividing wall. These eight (8) PVC couplers are a shared resource and are available to all teams on either side of the game field table. Once a robot moves a PVC coupler from the top of the wall onto their side of the playing field, it will remain in play only on that side of the table for the remainder of the match.

NOTE: Team members are not allowed to adjust the initial placement of game elements themselves. If the team wishes to contest the initial placement of game elements prior to the beginning of gameplay, the team must request the referee to correct the placement.

4. GAME ELEMENT PLACEMENT

The diagram below shows the initial set-up of the playing field with placed game elements. Note: the exact placement of the dollar bills and LEGO Bricks may differ slightly each match.



5. INTERACTING WITH GAME ELEMENTS

All eighteen (18) game elements are available to teams to be combined and used to make widgets. A widget is defined as a combination of exactly 2, 3, 4, or 5 elements that are touching each other, but not touching a robot.

Teams can interact with game elements in two ways:

Game Elements in Playing Field
When located in the playing field, game elements can be pushed, picked up, manipulated and moved by the team's robot. The only way to interact with elements on the playing field is through the robot. Team members may not touch game elements. Game Elements are considered "in the playing field" if they are NOT COMPLETELY inside a Safe Zone.

Game Elements in Safe Zone
If game elements have been moved to the Safe Zone and are completely inside the Safe Zone, the team's Widget Builder may touch, pick up or reconfigure them as long as they remain completely inside or are returned to the Safe Zone. The team's Widget Builder may pick up and hold those game elements during the match, but they must be returned to the same Safe Zone that they were picked up from. When game elements are placed back in a Safe Zone, they must be completely inside the black line defining the perimeter of the Safe Zone.

If any game element is touched by a team member under circumstances that do not conform to the rules of the game, they will be removed from play by the referees for the remainder of the match.

6. ROBOT REQUIREMENTS

Robots must be built exclusively of LEGO-branded building elements. Teams are allowed to use exactly one LEGO programmable processing unit; which could be a SPIKE Prime, EV3, NXT, or RCX controller.

Teams are allowed to use any number of LEGO-branded motors on their robots.

Teams are encouraged to use LEGO-branded sensors on their robots, including: light sensors, color sensors, touch sensors, and gyro sensors. Sound sensors, infrared sensors, magnetic compass sensors, and ultrasonic sensors are not allowed to be used for this competition.

Teams are required to enter a custom name on their LEGO programmable processing unit prior to arriving at the competition venue.. The name must match the official team name they are registered under.

Teams are encouraged to enable Bluetooth on their robot's programmable processing unit and pair with it prior to arriving at the competition venue. Teams are NOT allowed to attempt to pair/connect to any other robot via Bluetooth.

Teams are not allowed to melt, deform, cut, bend, glue, solder, or alter LEGO elements for use in their robots.

Non-LEGO parts or other extra items are NOT allowed. Glue or adhesive is NEVER allowed to be used on LEGO parts for any reason. Tape is not allowed for any reason other than labeling parts.

The robot must be able to fit inside a **10" by 10" footprint** at the beginning of each match. There are no constraints on the height of the robot at the beginning of the match. Referees will check for compliance prior to the start of every match. The robot must stand alone during referee measurement and no team member may touch the robot during or after measurement, except to start the robot.

7. SOFTWARE & CONTROLLERS

Teams are allowed to use their choice of software to program for the 30-second autonomous period of game play. Lego Mindstorms is the recommended software for autonomous programming, but not required.

Teams are allowed to use their choice of Bluetooth control system for the 90-second driver-controlled period of game play. Lego Commander App is the recommended control system for autonomous programming, but not required. Bluetooth is the only acceptable form of remote control. Infrared, WiFi or other modes of wireless or wired connectivity are not allowed in this competition.

8. TEAM PERSONNEL

Teams are composed of three to five students. During team game play, only three team members are allowed at the playing field. These three team members will be identified as the Spokesperson, the Robot Driver, and the Widget Builder.

The **Spokesperson** is the team member responsible for communicating with alliance partners and referees.

The **Robot Driver** is the only team member allowed to operate the robot, during both the autonomous period and the driver-controlled period.

The **Widget Builder** is the only team member allowed to touch game elements that are located inside the Safe Zone. This person is also allowed to touch the robot if it is touching the Safe Zone.

If a team has more than three team members, the additional team members may watch the matches from the designated audience area. In the event of a team winning an award, all registered members of the team will be recognized for their contributions.

9. ALLIANCE PARTNERSHIPS

Teams will play five (5) qualification matches with alliance partners. Team alliances for the five (5) qualification matches will be randomly assigned prior to the start of the competition. Alliance partner teams will work together to accomplish as many tasks and earn as many points as possible during the match. Points earned in each match will be shared equally between the two alliance partner teams.

In the BUILD: WIDGETS Robotics Challenge, there is an expectation that alliance partner teams will communicate in advance of their match to discuss tactics and plan a strategy for the match. Every team will have designed their robots to be able to accomplish a unique set of tasks, so each team will have their own strengths and their own specialty. Teams are encouraged to use their time in the “on deck” area prior to their match to coordinate their efforts and create a strategy for accomplishing game tasks together.

During the qualification matches, the team’s alliance partner will be randomly assigned, but in the finals tournament, top-ranking teams will be able to choose their own alliance partners. Because of this, teams will want to select alliance partners with abilities that complement their own strengths. Scouting during the qualification matches is a good way to learn the capabilities and limits of the teams and robots competing at the competition. Scouting is also important to find out how you will complement other teams in your alliance and how you match up against your opponents.

10. QUALIFICATION MATCHES

BUILD: WIDGETS matches consist of a 30-second autonomous period followed by a 90-second driver-controlled period. During the 30-second autonomous period, robots will move on their own to accomplish predetermined tasks and earn points. At the end of the autonomous period, referees will pause the match and assess points before starting the 90-second driver-controlled period. During the driver-controlled period, teams will remotely control (via Bluetooth) their robot to accomplish tasks and earn points. At the end of the driver-controlled period, referees will again assess points and figure the match scores.

The BUILD: WIDGETS Robotics Challenge requires teams to build a robot that will help them gather elements, construct widgets, and move them to their scoring locations. During the matches, there is a great deal of communication between alliance teams and interaction between team members and their robots.

30-Second Autonomous Period

Referees will check for robot compliance prior to the start of every match. The robot must be able to fit inside a 10” by 10” footprint at the beginning of each match. There are no constraints on the height of the robot at the beginning of the match. The robot must stand alone during referee measurement and no team member may touch the robot during or after measurement, except to start the robot.

The robot must start each qualification match touching its Safe Zone. “Touching the Safe Zone” means that some part of the robot must be touching the white mat inside of the black line defining the perimeter of the Safe Zone.

When time begins for the 30-second autonomous period, the robot may only move as a result of a program stored on its processing unit. Team members are not allowed to touch or pick up the robot once the clock begins..

If the robot is touching the Safe Zone, the team’s Widget Builder may change and restart programs, reconfigure robot elements, and reposition or reorient the robot. If the robot is repositioned or reoriented, it must be still touching the Safe Zone before continuing or starting a new autonomous task.

If game elements are moved to the Safe Zone and are completely inside the Safe Zone, the team’s Widget Builder may touch, pick up or reconfigure them as long as they remain inside or are returned to the Safe Zone.

At the end of the 30-second autonomous period, referees will assess points using the Game Play Score Sheet. Teams will not be awarded any points for tasks accomplished after the 30-second alarm is sounded. Once the referees have assessed points, teams will recover their robot and move it to the Safe Zone to launch their driver-controlled program.

90-Second Driver-Controlled Period

Before the referees start the 90-second driver-controlled period, they will ensure that all teams have successfully connected their remote control system and are ready to continue. Bluetooth is the only acceptable form of remote control in this competition. Infrared, WiFi or other modes of wired or wireless connectivity are not allowed.

Like the Autonomous Period, the robot must be touching the Safe Zone at the beginning of the 90-second Driver-Controlled period. Referees will NOT re-check compliance for the start of the Driver-Controlled period.

During the 90-Second Driver-Controlled Period, team members are not allowed to touch or pick up the robot while it is on the playing field.

If the robot is touching the Safe Zone, the team’s Widget Builder may change and restart programs, reconfigure robot elements, and reposition or reorient the robot. If the robot is repositioned or reoriented, it must be touching the Safe Zone before continuing with game play.

If game elements are moved to the Safe Zone and are completely inside the Safe Zone, the team’s Widget Builder may touch, pick up or reconfigure them as long as they remain inside or are returned to the Safe Zone.

Teams must take special care to stop all movement of their robot at the end of the 90-Second Driver-Controlled Period. Teams will not be awarded any points for tasks accomplished after the 90-second alarm is sounded. At the end of the 90-Second Driver-Controlled Period, referees will assess points using the Game Play Score Sheet.

11. SCORING EXPLAINED

Acquire Elements
During the 30-Second Autonomous Period, alliance teams can earn points by claiming the coupler game elements from the center divider wall. While the coupler elements are on the wall, they are available to both alliances. Once a coupler is removed from the wall, however, it is only available to the alliance teams on one side of the playing field. Alliances will earn 5 points for every coupler game element touching their side of the playing field at the end of the 30-Second Autonomous Period.

Gather Elements
During the 30-Second Autonomous Period, alliance teams can earn points by gathering game elements and moving them inside the Safe Zone. Alliances will earn 5 points for every game element located completely inside the Safe Zones at the end of the 30-Second Autonomous Period.

Get Money
The dollar bill will be randomly placed by the referees inside the big circle at the beginning of the match. Alliance Teams can earn points by parking their robot on the dollar bill at the end of the 30-Second Autonomous Period and/or at the end of the 90-Second Driver Controlled Period. “Parking their robot on the dollar bill” means that the robot must be stopped on (touching) or over (breaking the plane of) the dollar bill when time is up.
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Make Widgets
Alliance teams will earn points by building widgets and transporting them to scoring locations. A widget is defined as a combination of exactly 2, 3, 4, or 5 elements that are touching each other, but not touching a robot. Widgets are scorable once they are moved to a scoring location. Widgets located completely inside the big circle will earn 10 points for every element that make up the widget. “Inside the big circle” means all elements that make up the widget are completely inside the black line defining the perimeter of the circle. Widgets touching one of the five (5) small targets will earn 20 points for every element that make up the widget. “Touching a target” means that one part of the widget must be touching a black line that defines the target’s shape.

Clean Up
Alliance teams will receive a 5-point penalty for each game element that is not part of a widget and located completely inside the big circle at the end of the 90-Second Driver-Controlled period.

12. QUALIFICATION RANKING

A team's scores from each of its five (5) qualification matches will be combined to get an overall team ranking score. At the conclusion of all qualification matches, all teams will be ranked from first through last, based on their overall team ranking score. If multiple teams are tied with the same ranking score, ties will be broken based on the highest individual match score.

13. ALLIANCE SELECTION

Once the qualification matches are complete and all teams have earned an overall ranking score, the eight (8) highest ranked teams will select an alliance partner for the finals tournament. The alliance selection process allows the top eight (8) teams to choose an alliance partner with whom they will compete in the single-elimination Finals Tournament in order to decide the BUILD: WIDGETS Robotics Challenge champion.

The Alliance Selection process is as follows:

Each team chooses one student to act as the team's representative. These representatives will report to the competition area at the appointed time to represent their teams in the Alliance Selection. The top eight (8) ranked teams are called to the floor first.

The student representative of the highest-ranked team is asked to step forward as the alliance captain to invite another available team to join their alliance.

A team is considered available if they are not already part of an alliance or if they have not already declined an alliance invitation.

If a team accepts the invitation, they are moved into that alliance. If a team declines, they cannot be invited to another alliance, but are still available to select their own alliance if the opportunity arises. If a team declines, the alliance captain from the inviting team must extend an invitation to another team.

The selection continues until all eight (8) alliance captains have been appointed and chosen eight alliance partners.

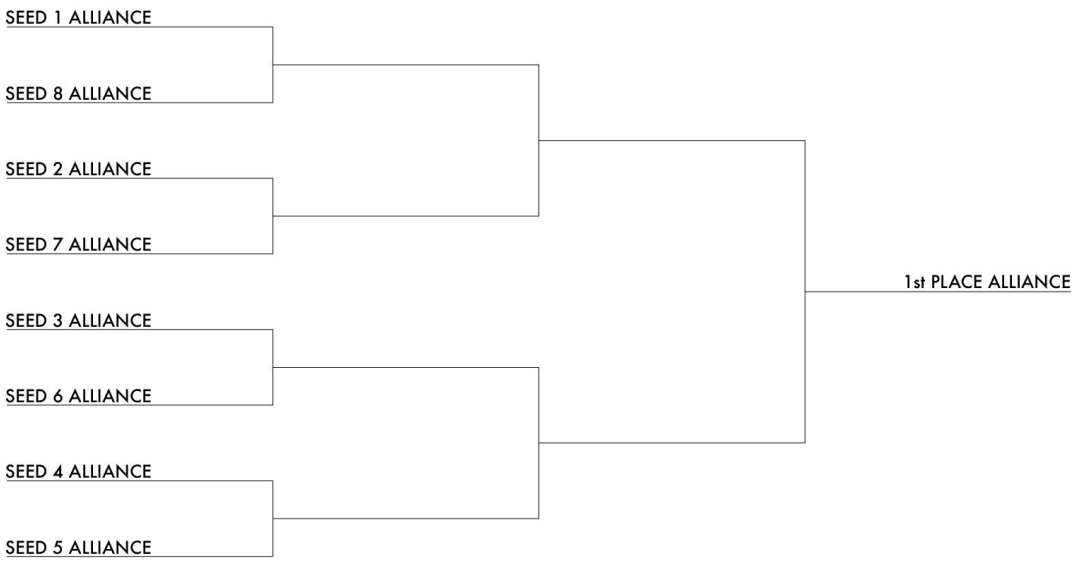
14. FINALS TOURNAMENT

The Finals Tournament matches are played to decide the BUILD: WIDGETS Robotics Challenge champion. The matches are played in a seeded format where the top seed alliance goes up against the 8th seed, the number 2 seed goes up against the 7th seed, and so on.

Matches during the Finals Tournament will follow the same format and adhere to the same rules and procedures as the Qualification Matches.

In the Finals Tournament matches, teams do not get ranking points. The match score of the two alliance teams will determine the win, loss or tie for that bracket. If an alliance wins a match, they continue to the next round of the tournament. If they lose a match, they are out of the tournament bracket. If there is a tie between two alliances, the tie will be broken by the 30-Second Autonomous Period score.

FINALS BRACKET



15. DESIGN NOTEBOOK

Teams will document the design, strategy, and building procedures of their robot as they prepare for competition day. Documentation will include daily handwritten notes, testing data, sketches and photos, sample code, and more. Documentation should be compiled in a way that illustrates the team's journey through the design process and demonstrates problem-solving and critical thinking. Teams will submit a design notebook at the check-in table on competition day that will be scored by referees during the qualification matches.

Teams should refer to the BUILD: WIDGETS DESIGN NOTEBOOK SCORING RUBRIC as they develop their notebooks.

16. AWARDS

The following awards will be presented at the conclusion of the BUILD: WIDGETS Robotics Challenge competition:

1st Place Alliance (2 teams)
All members of the two alliance teams winning the final match of the tournament will receive an award recognizing them as 1st Place Alliance winners.

2nd Place Alliance (2 teams)
All members of the two alliance teams losing the final match of the tournament will receive an award recognizing them as 2nd Place Alliance winners.

Design Award (1 team)
Referees will present the Design Award to all members of the team who submitted the top-scoring Design Notebook.