

Agenda

- Team schedule for next week
- Game overview
- Input from Kettering University
- Considerations
- Breakout groups



Season Schedule

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Mechanical 1	Design	Develop Design	Develop/ Fabricate	Fabricate/ Assemble	Finish Assembly	Make Changes
Mechanical 2	Design	Develop Design	Develop/ Fabricate	Fabricate/ Assembly	Finish Assembly	Make Changes
Mechanical 3	Design	Develop Design	Develop/ Fabricate	Fabricate/ Assembly	Finish Assembly	Make Changes
Controls	Design	Create IO Sheet	Board/ Wire Layout	Create Board	Wire Robot	Make Changes
Programming	Design	Code Development	Create Code	Continue Code	Finish/Test Code	Test Code
CAD	Design	CAD	CAD	CAD	CAD	CAD
Design/Drive	Pick Design			Choose Drive Team	Practice	Practice

Weekly Schedule

Tuesday:

Design Review 6:30 PM - 9:30 PM

- 1 leader from each engineering team (both schools) and 1 mentor
- The rest of the teams will not meet today

Saturday:

Robot Status/ Schedule 9:00 AM - 10:00 AM

- 1 leader from each engineering team (both schools) and 1 mentor
- Teams will show up and can continue work while this meeting is going on

Team Meeting 2:30 PM

- The entire team will meet (engineering and business)
- Team leaders will give brief update for their sub-teams
- Team leaders will tell everyone their meeting plans for the next week

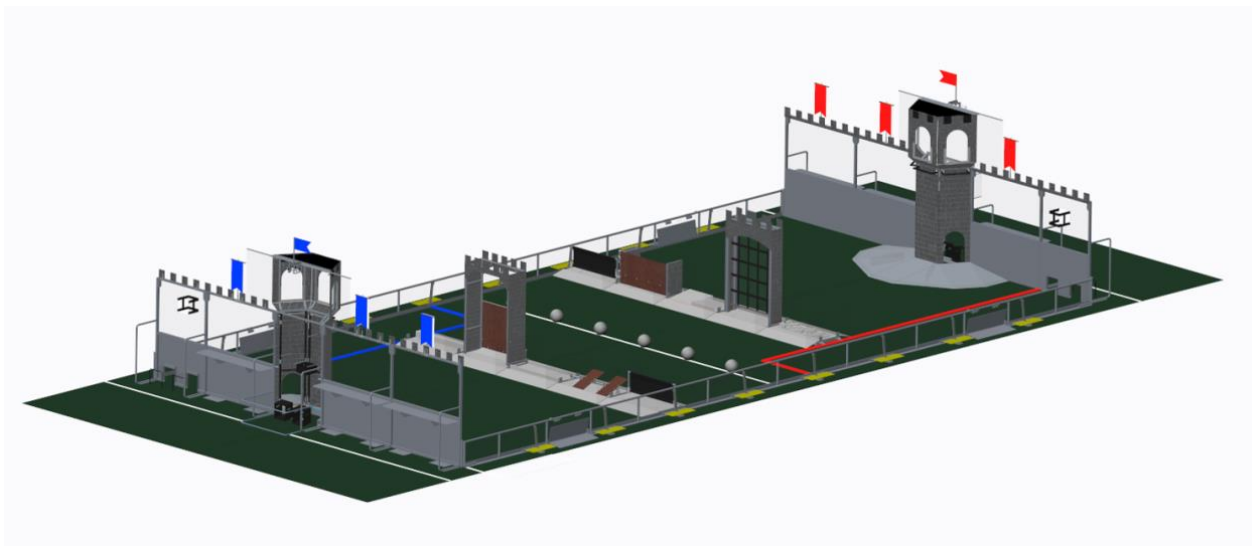
Game Overview
Seeding and Playoffs
Definitions
Safety
The Arena
Game Play
Robot
Scoring
Fouls
Key Date
Discussion



Game Overview

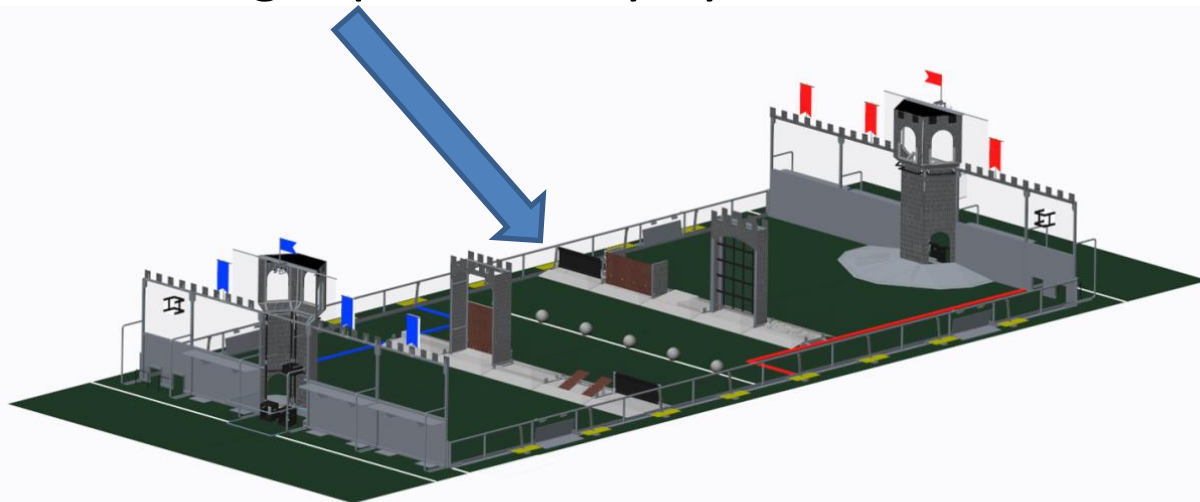


- *FIRST STRONGHOLD is played by two alliances of three teams each.*
- Alliances compete against each other to breach their opponents' defenses, known as outer works, and capture their tower.
- They score points by crossing elements of their opponents' outer works, scoring boulders in their opponents' tower goals, and surrounding and scaling their opponents' tower itself.



Game Overview - Start

- *FIRST STRONGHOLD* is played on a 27 ft. by 54 ft. field. Each alliance commands one tower, five defenses, and a 'secret passage' which allows their robots to restock on ammunition, called boulders.
- One defense in each alliance's set of five, the low bar, is a permanent part of the field. Three defenses are selected strategically by the alliance prior to the start of their match. The final defense changes periodically by audience selection.



Game Overview - Autonomous

- Each *FIRST STRONGHOLD* match begins with a 15-second **autonomous period** in which robots operate independently of human control.
- During this period, robots attempt to cross opposing defenses and score in the opposing tower.

Action	Value
Reaching a defense	2
Crossing a defense	10
Boulder in a low tower goal	5
Boulder in a high tower goal	10

Game Overview – Teleop Period

- During the remaining 2 minutes and 15 seconds of the match, called the **teleop period**, robots are controlled by student drivers from behind their castle wall at the end of the field. Teams on an alliance work together to cross defenses, weaken the opposing tower by scoring boulders in it, and finally surround, scale and capture the tower.

Action	Value
Crossing a defense	5
Boulder in a low tower goal	2
Boulder in a high tower goal	5
Challenging the tower (per Robot)	5
Scaling the tower (per Robot)	15

Game Overview – Ranking Points

- Alliances are ranked by a combination of their Win-Loss-Tie record, breach success, and tower capture success.
- A win is determined by comparing total match points between alliances at the end of the match and earns an alliance two ranking points. Ties earn an alliance one ranking point.
- Capturing an opponents' tower at the end of the match earns each team on the alliance one ranking point.
- Breaching an opponents' outer works by crossing four of the five defenses twice earns an additional ranking point.
- Ranking points are the **primary way teams are ranked** during qualification rounds, so are very important.
- Note that while only one alliance can win a match, either, both, or none may capture a tower or breach outer works.

Game Overview – Ranking Points

Per qualification match per team	Points
Win	2
Tie	1
Loss	0
Capturing Opponents' Tower (win or lose)	1
Breaching Opponents' Outer Works (win or lose)	1

Seeding

- All teams seeded during qualification matches.
- Teams ranked in this order:

Order	Points
1	Ranking score
2	Cumulative sum of Auto Points
3	Cumulative sum of scored scale and challenge points
4	Cumulative sum of High and Low Goal Points from Auto and Teleop
5	Cumulative sum of Crossed Undamaged Defense points (Auto and Teleop)
6	Random sorting by FMS

Playoff Matches

- Playoff Advancement
 - Alliances paired based on rank
 - 1 vs 8
 - 2 vs 7
 - 3 vs 6
 - 4 vs 5
 - First alliance to win two matches advances

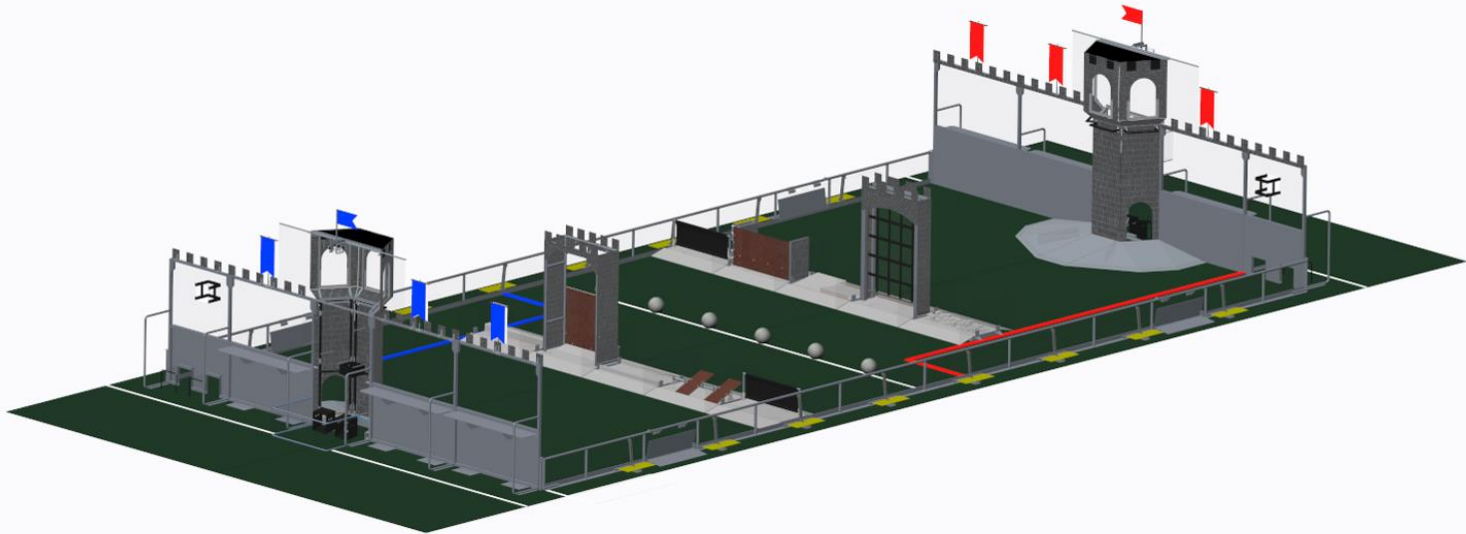
Definitions

- **Alliance:** Set of up to four FRC teams who play FIRST Stronghold together.
- **Breached:** State of an outer works once four out of its five defenses have been damaged (strength is zero)
- **Captured:** State of tower if, at end of Match, it is weakened, and it is surrounded such that each of the 3 opponent robots has scaled (fully supported by tower attached to at least one rung and with all bumpers fully above height of the low goals) or challenged (fully supported by tower but not scaled) a unique face of the tower
- **Team positions:**
 - COACH: Student or adult mentor designated as the team coach and advisor during the match (1)
 - DRIVER: Pre-college student (2)
 - HUMAN PLAYER: Pre-college student responsible for entering game pieces into playing field

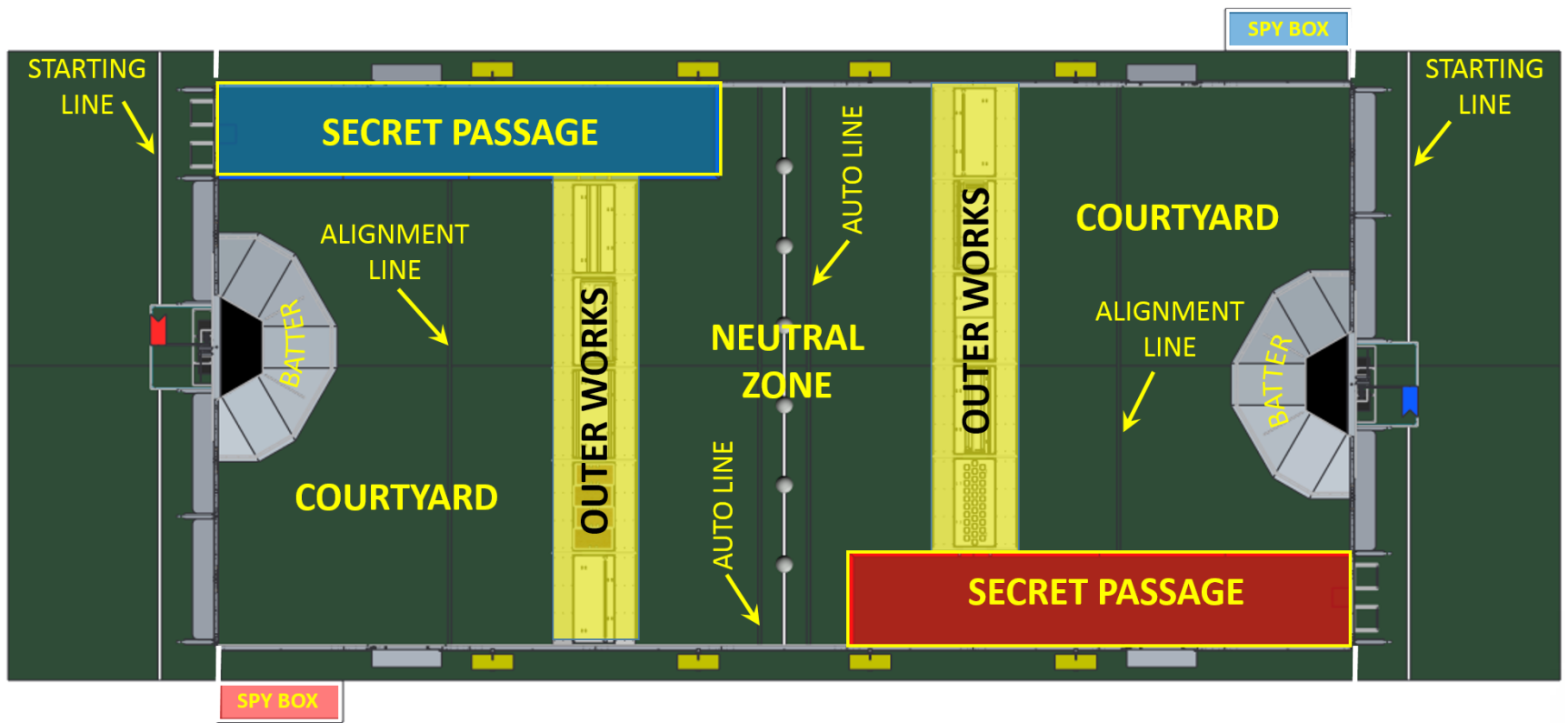
Safety

- Robots whose operation or design is dangerous or unsafe are not permitted.
- Other safety rules are in the manual.

The Arena



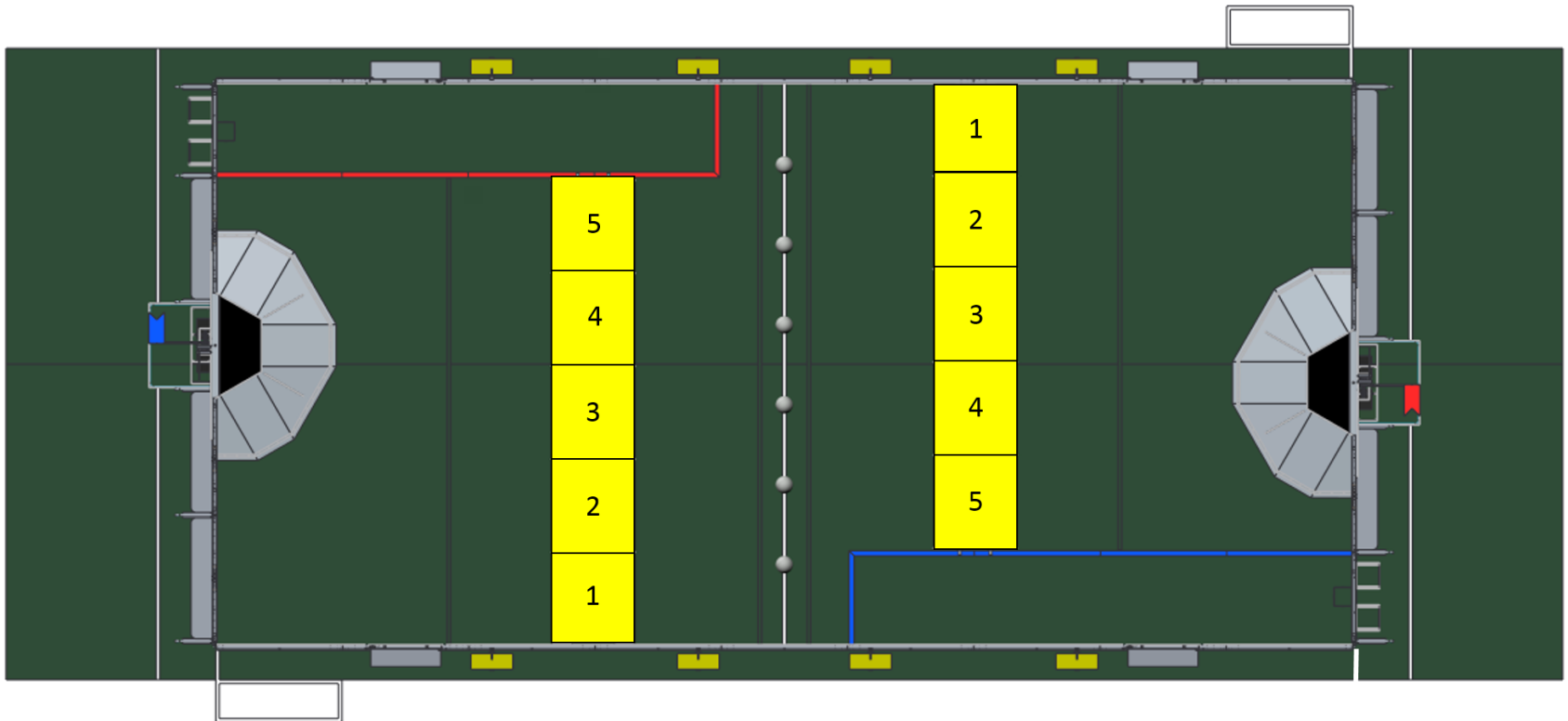
FIRST STRONGHOLD is a medieval tower defender game in which two alliances of three teams each select defenses to fortify their outer works before competing simultaneously to score points while breaching the opponent's outer works and capturing the opponent's tower.



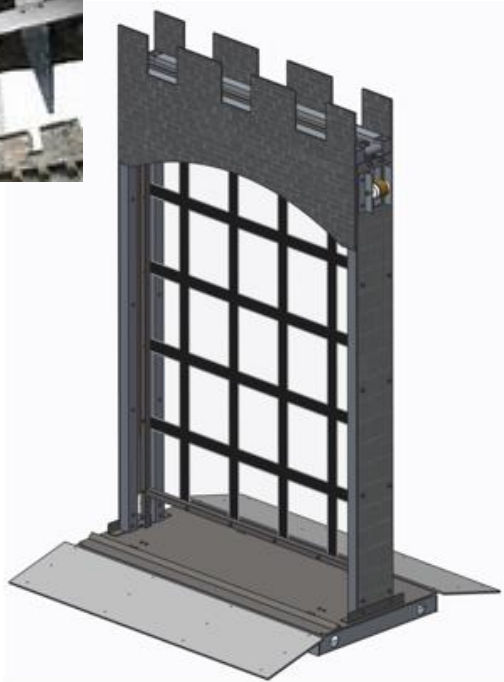
- The OUTER WORKS consists of a series of five defenses, five platforms, and five shields arranged in a line across the field and is **designed to impede the passage of robots and boulders** in to the courtyard.

Defenses are selected as follows:

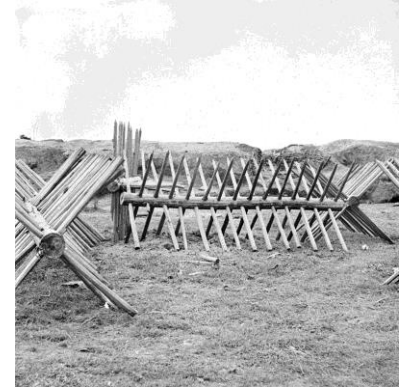
1. Low Bar
2. ALLIANCE selected
3. Audience selected
4. ALLIANCE selected
5. ALLIANCE selected



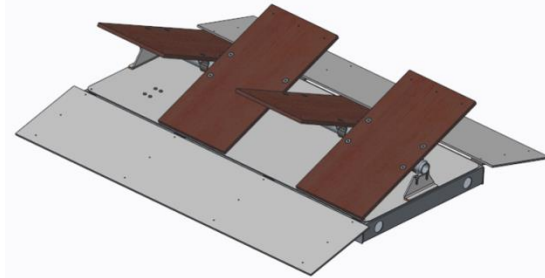
Defense Category A



Portcullis

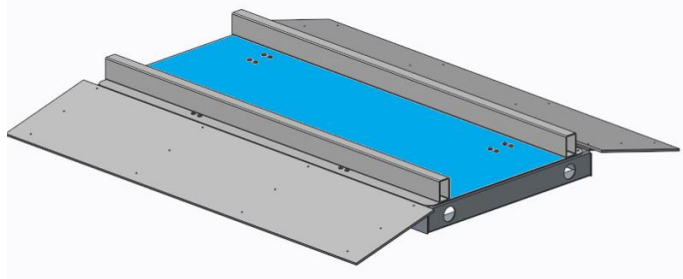


OR



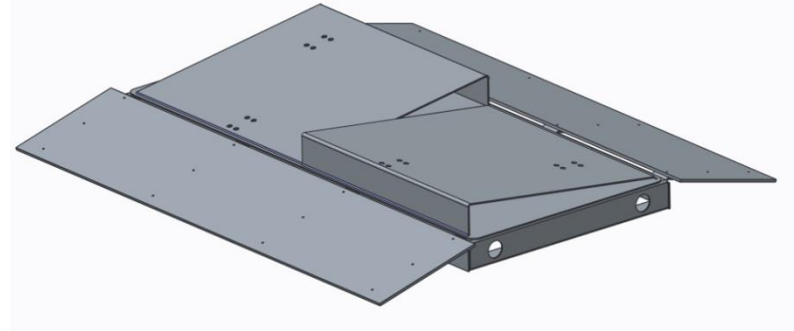
Cheval de Frise

Defense Category B



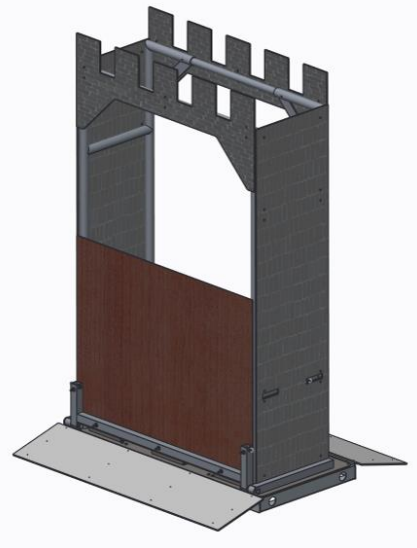
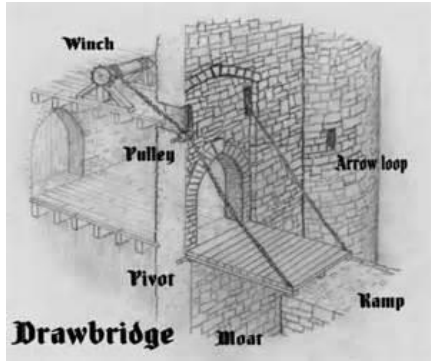
Moat

OR



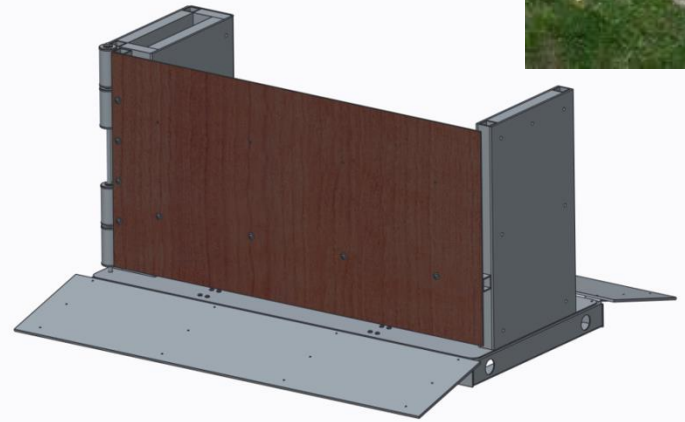
Ramparts

Defense Category C



Drawbridge

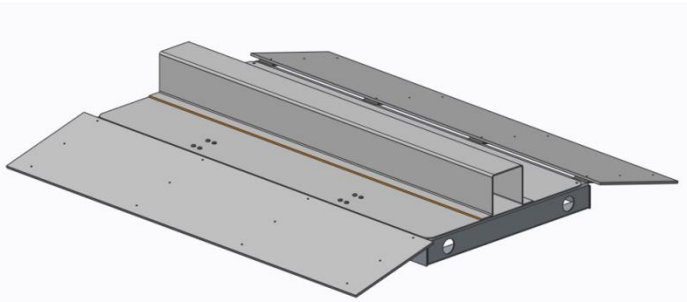
OR



Sally Port

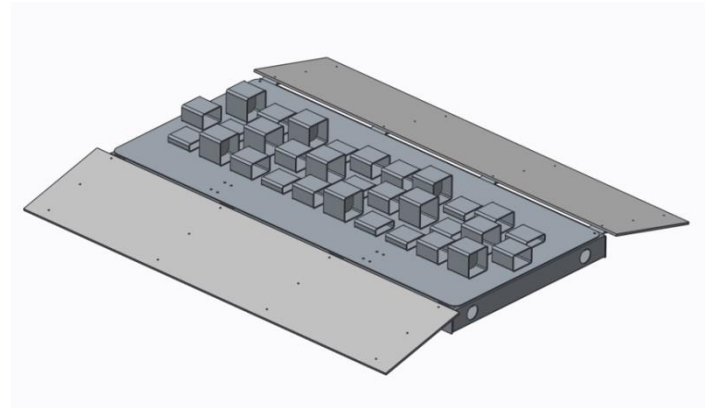


Defense Category D



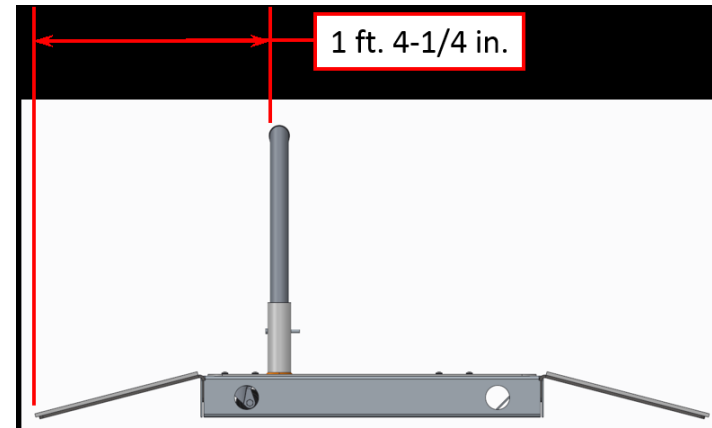
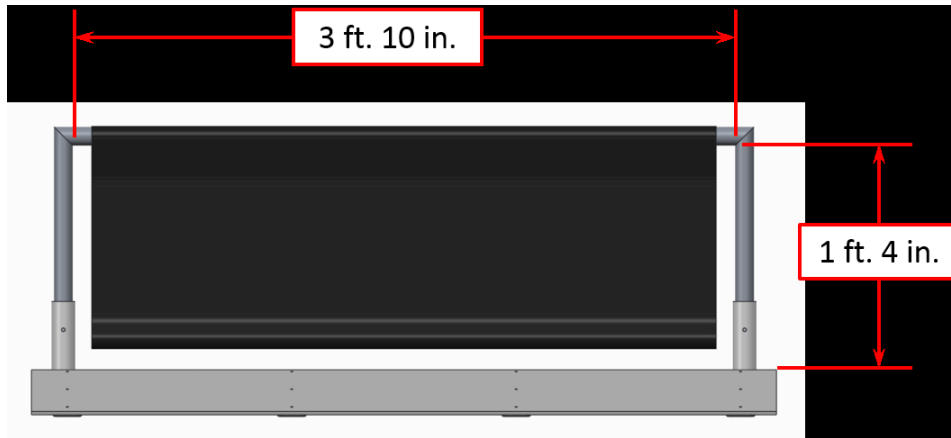
Rock Wall

OR



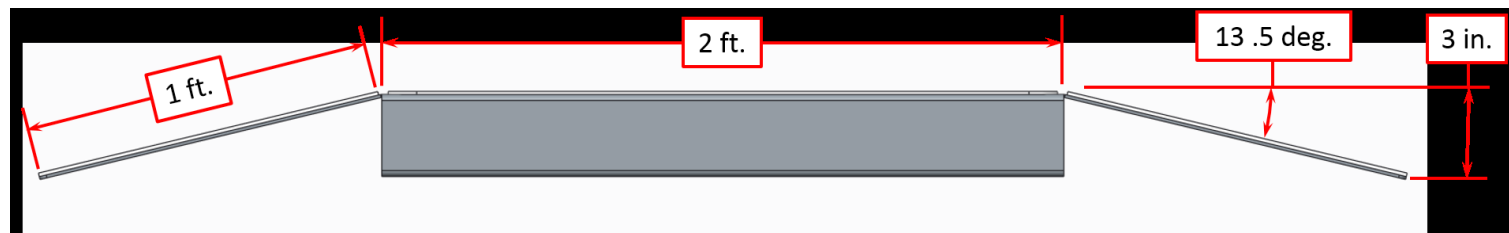
Rough Terrain

Low Bar (always in position 1)

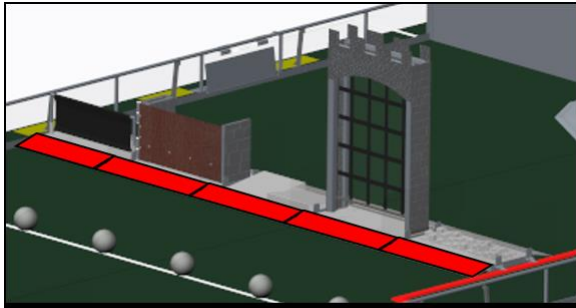


Defenses positioned on Platforms

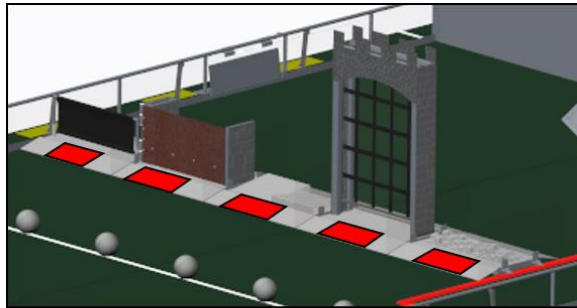
PLATFORMS are a 4 ft. 2 in. wide, 2 ft. deep and 3 in. tall base for a defense and associated ramp. Each platform is permanently installed on the field and is abutted by translucent polycarbonate ramps on each long edge. Ramps are 4 ft. 2 in. wide, 1 ft. deep, resulting in a 13.5 deg. angle.



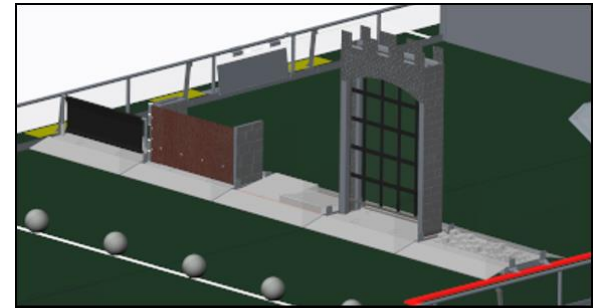
Each platform has indicator lights beneath the Ramps to indicate strength. Once reduced to half strength (1 passage), the outer lights will turn off, leaving the center third on. Once reduced to zero (0) all lights for that defense will turn off as indicated in



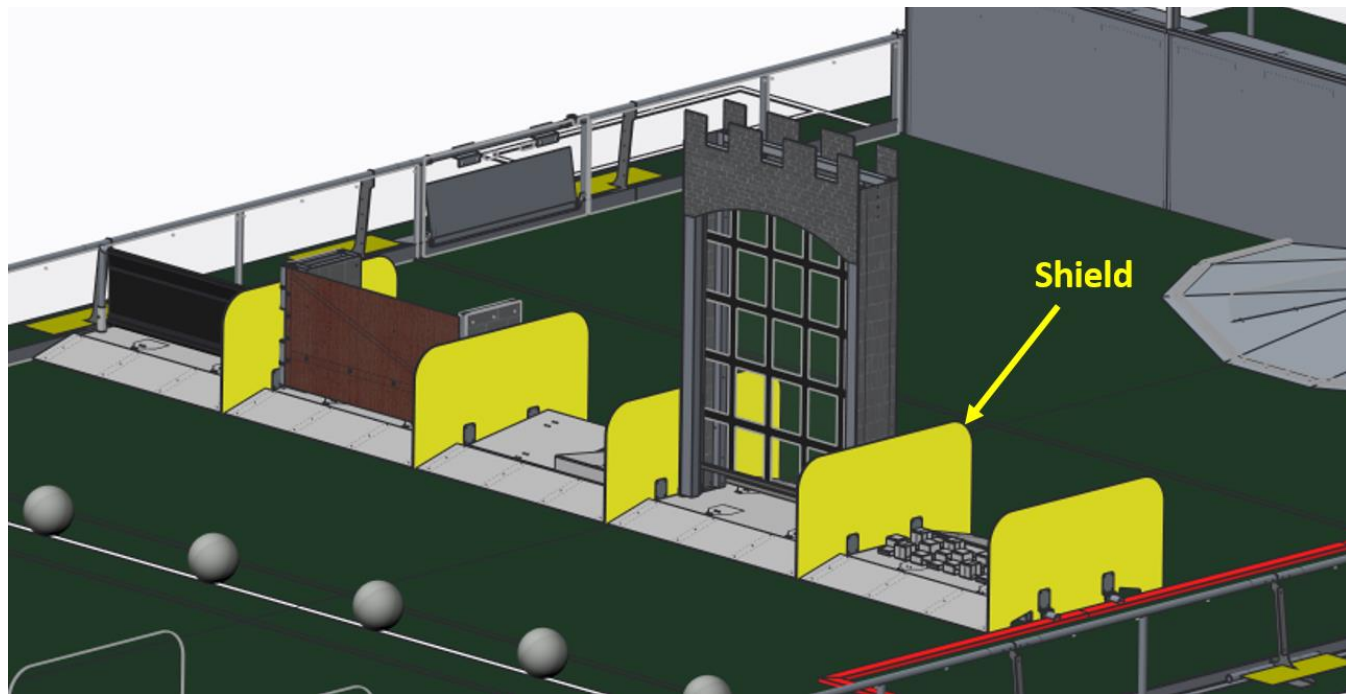
Full strength



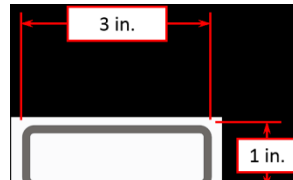
Half strength



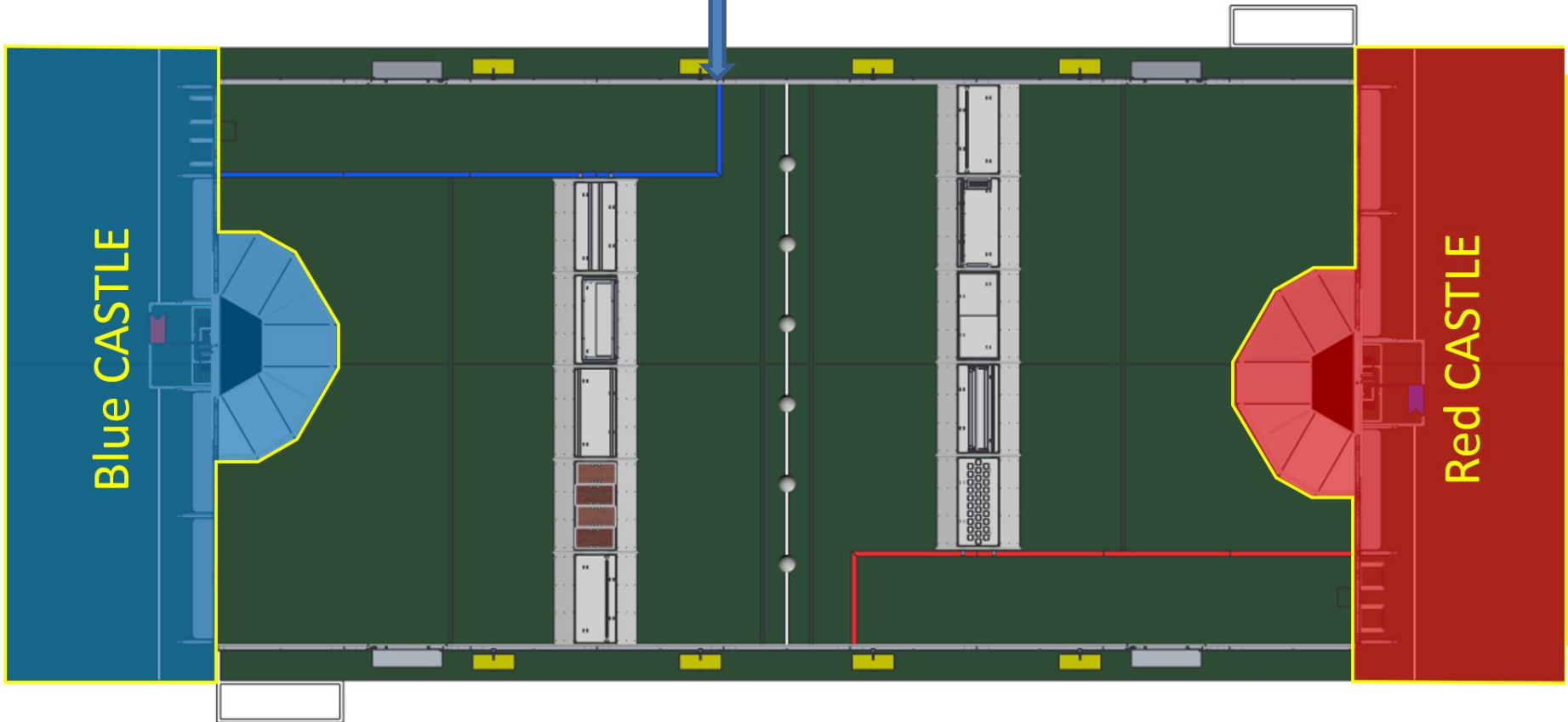
Zero strength



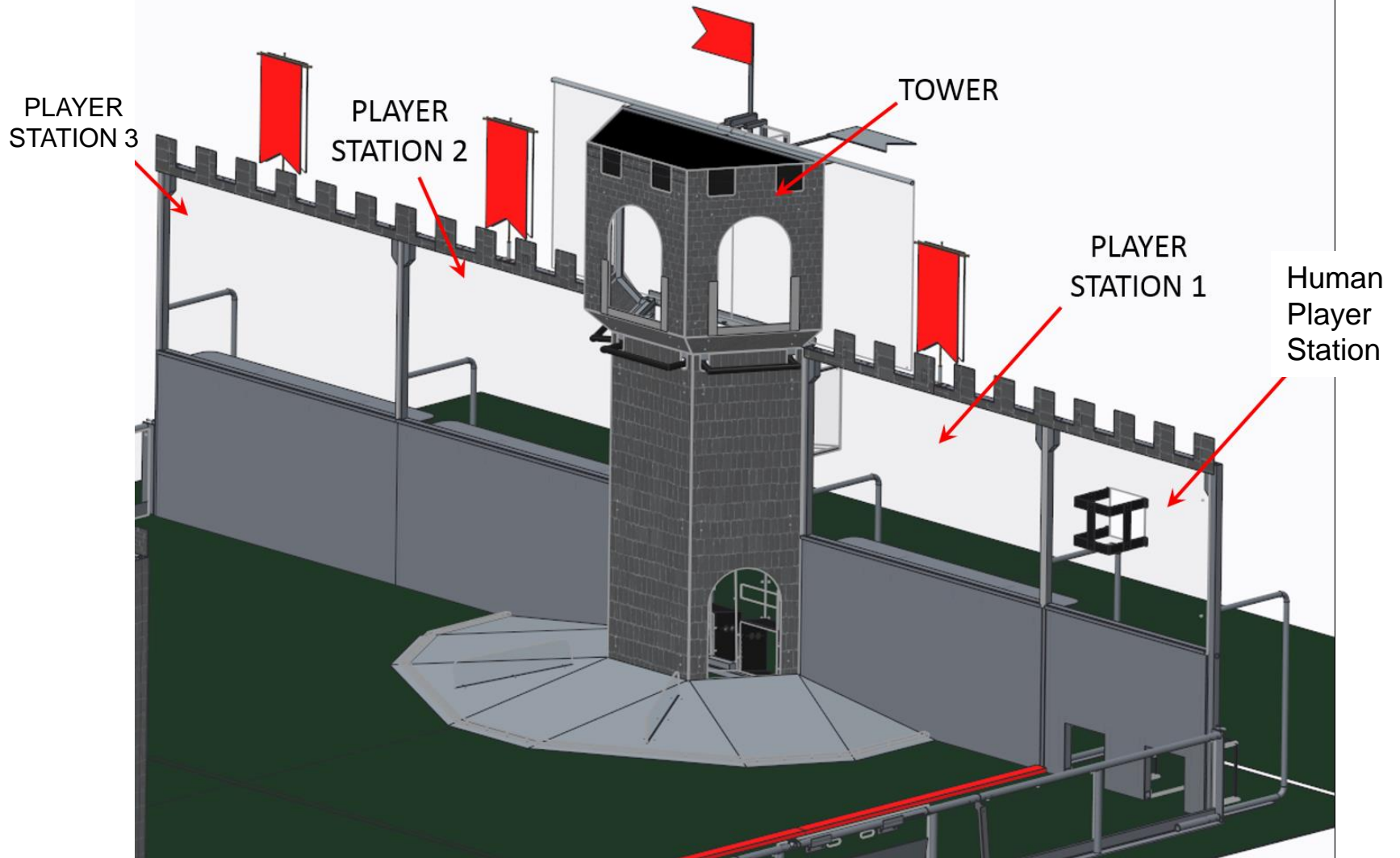
Secret Passage and Castle



Berms are around 2 sides of secret passage



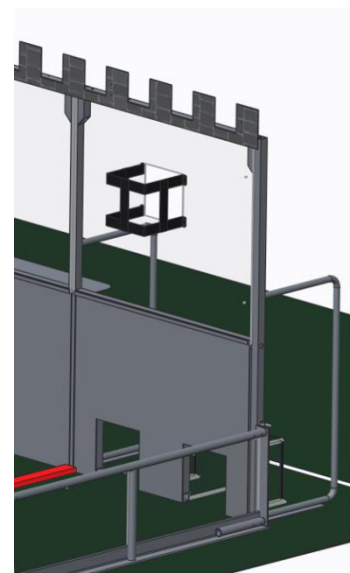
Player Station



Human Player Station

The Brattice is the hole used by an alliance to introduce boulders to the field. The hole is 10-1/2" square, and the bottom edge of the hole is 4 ft. 8 in. from the field carpet. There is a protective aluminum cage that mounts to the polycarbonate on the field side of the castle wall.

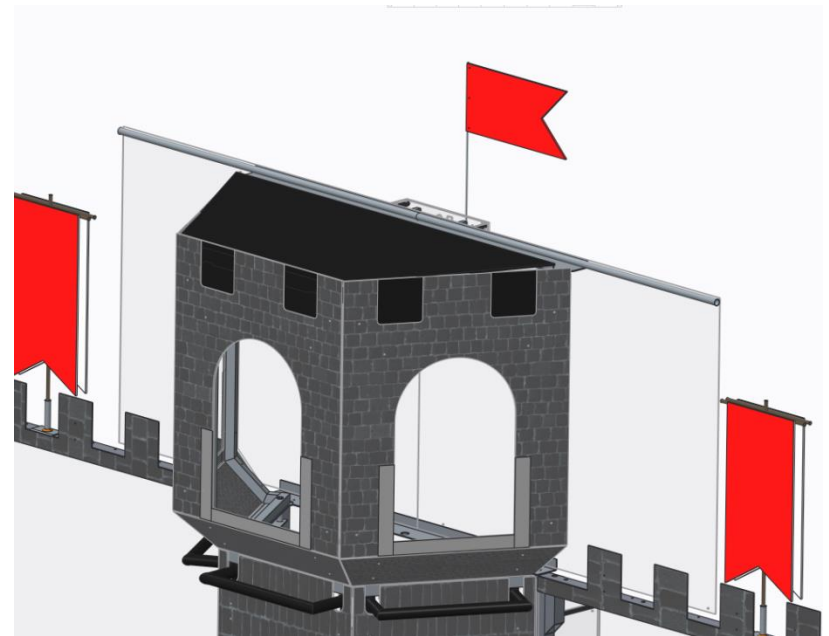
An embrasure is a hole at the bottom which can be used by an alliance to introduce boulders to the field. Each of two embrasures has an opening of 1 ft. by 1 ft. and a polycarbonate tunnel on the player station side of the hole. These tunnels are 1 ft. 3 in. long, and are designed to help prevent robot to human player contact.



Tower

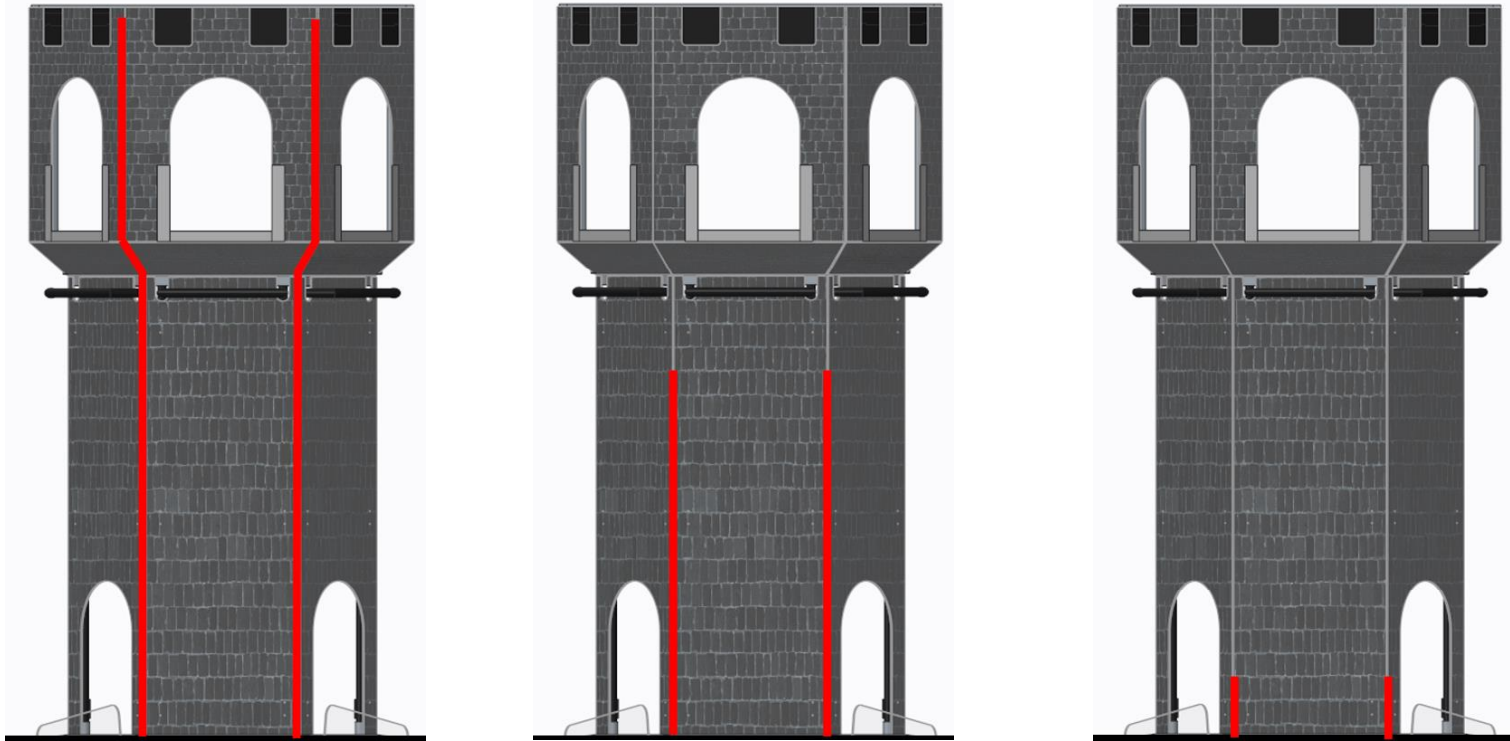
Each TOWER has three faces with rungs, five goals, a batter, and a corral.

A set of flags is on top of each tower: one red, one blue. Only one flag will be visible at a time. The color of the displayed flag indicates ownership of the tower. When a tower has been weakened, the flag matching the defending alliance will be lowered. If at the conclusion of the match a tower has been captured the flag matching the capturing alliance color will be raised



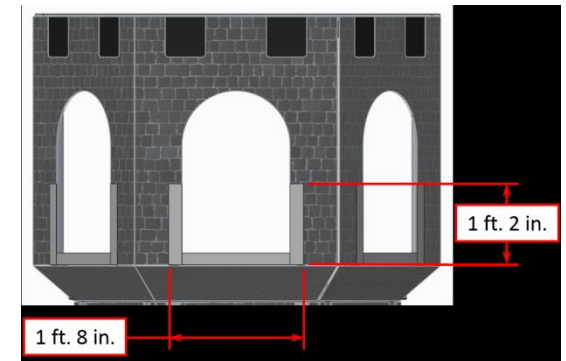
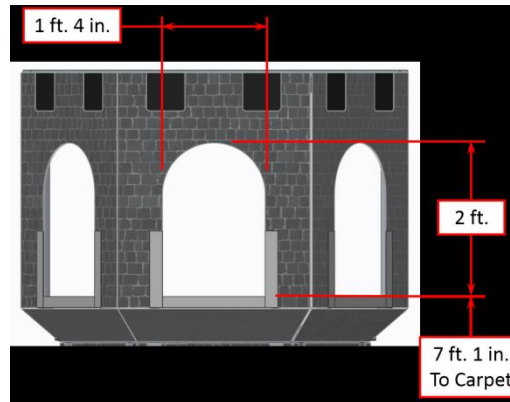
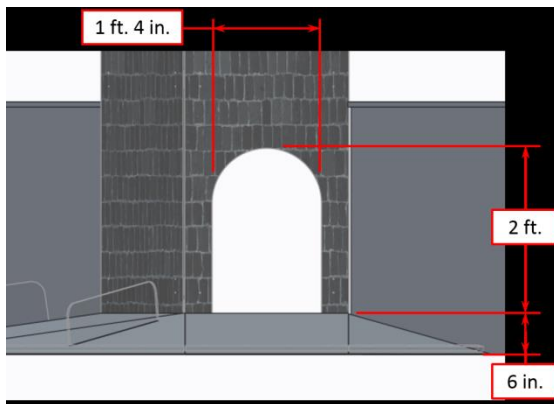
Tower Lights

Each tower has two LED light strings mounted to both vertical edges of the front face of the tower. During the match they indicate tower strength. As opponents score boulders in the tower, the strength is reduced and the lights begin to turn off, from the top to the bottom. The lights decrement eight times until the entire strand is off.



Tower Goals

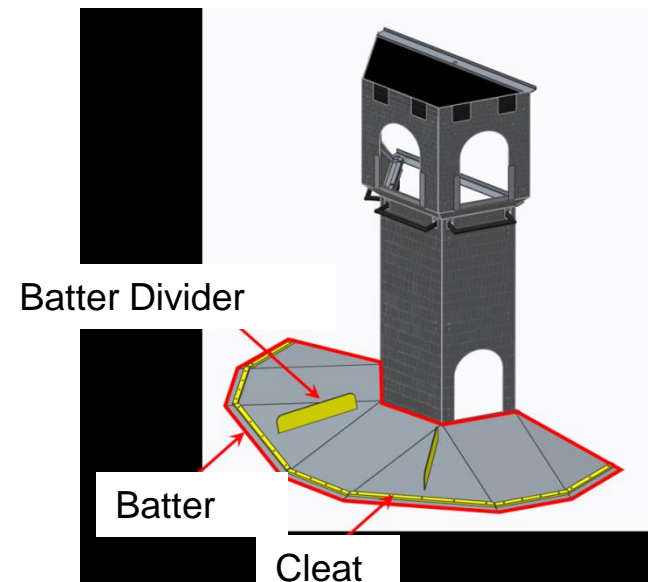
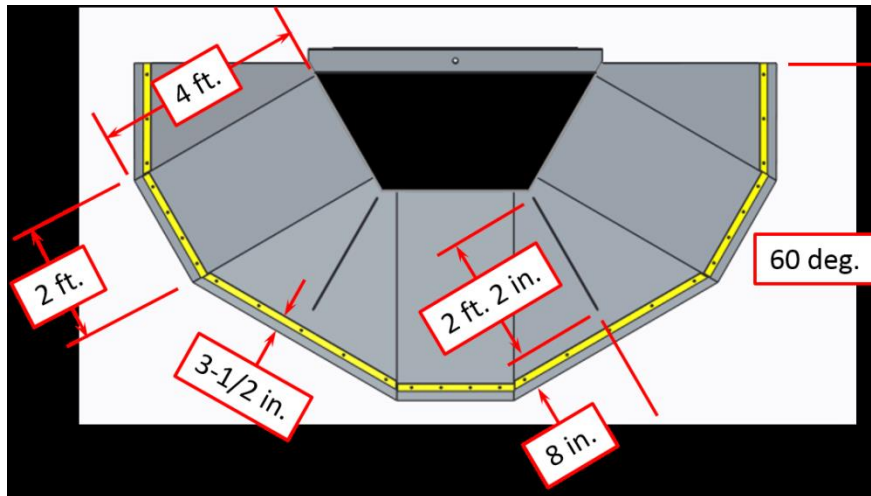
Each tower has five goals; two low and three high. Each goal has an opening in which boulders may be scored. Each goal is 1 ft. 4 in. wide by 2 ft. tall. The bottoms of the High goals are 7 ft. 1 in. from the carpet. The bottoms of the low goals are 6 in. from the flat field surface, at the same height as the top of the batter. Each of the high goals is marked with three strips of 2 in. retro-reflective material to form a u-shaped target. The targets are 1 ft. 2 in. tall and 1 ft. 8 in. wide.



Batter

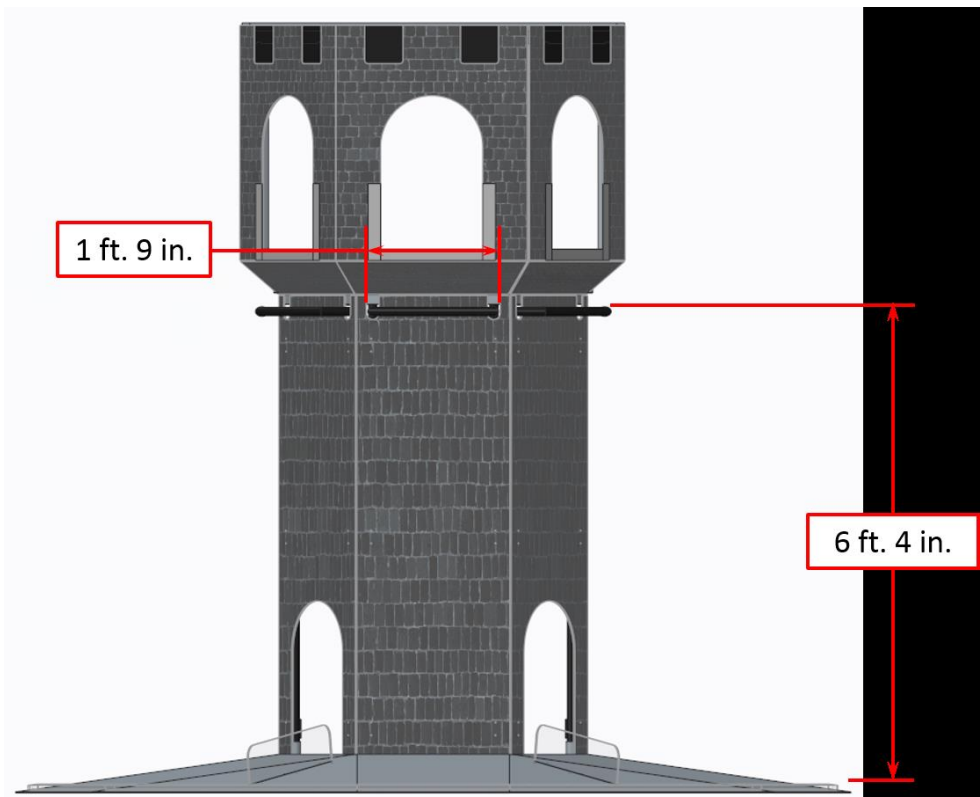


The batter is a series of seven ramps with two dividers that create the base of the tower. Ramps are 6-8 deg. inclines. The ramps directly in front of the low goals are 2 ft. wide and 4 ft. deep. The dividers are clear polycarbonate, 6 in. tall by 26 in. long, located 60 deg. from the face of the castle wall, and 8 in. from the leading edge of the ramp. Cleats are attached to the bottoms of the batter ramps to help prevent robots from rolling off at the conclusion of the match. They are parallel to and 3-1/2 in. from the bottom edge of each ramp. Cleats are plastic and 3/4 in. tall and 1-1/2 in. deep.



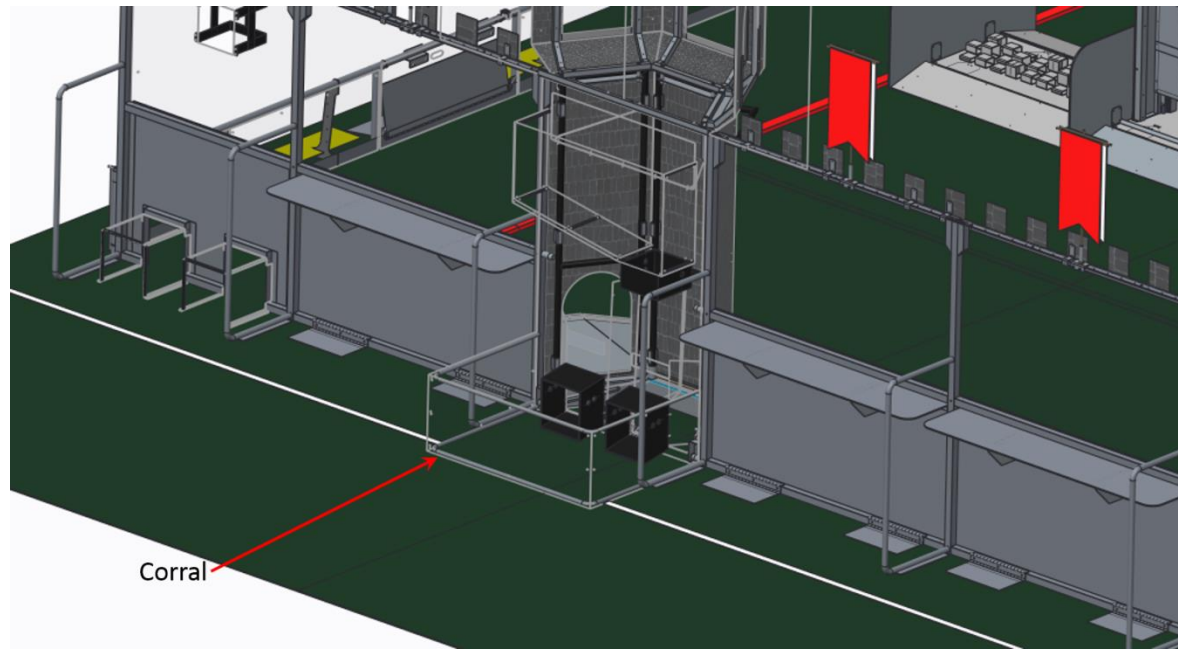
Scaling Rungs

A rung is a bar mounted on a TOWER face that is 1 ft. 9 in. wide and constructed of 1-1/2" Steel DOM Tubing. Each tower has three rungs, one on each face of the tower, designed to support scaling robots. The top of the rung is 6 ft. 4in. from the field carpet. The rungs protrude 5-1/4 in. from the face of the tower.



Corral

Once a boulder passes through the tower and is scored, it falls into the corral which is the collection area located at the rear base of the tower.



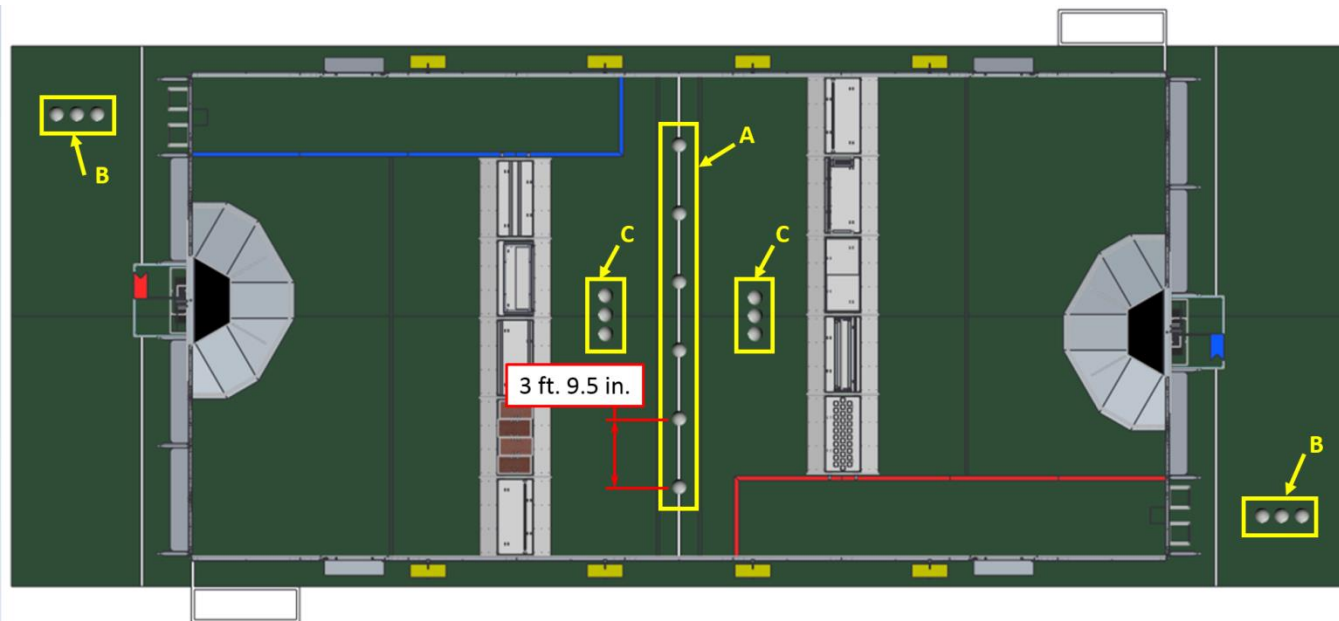
Boulders



Scoring elements are called boulders; 10 in. diameter, gray, Gopher SoftiBall coated foam.

Each match begins with eighteen boulders staged in the following manner:

- A. Six are staged evenly along the length of the Midline, 3 ft. 9-1/2 in. apart
- B. Three are staged in each castle
- C. Three per alliance are staged on or in each robot or in the castle.



The Game – Robot Positioning

When a drive team loads their robot onto the field they may elect to either pre-load one boulder in or on their robot such that the boulder is fully supported by their robot, or transfer their boulder to a human player in their castle.

When placed on the field robot must:

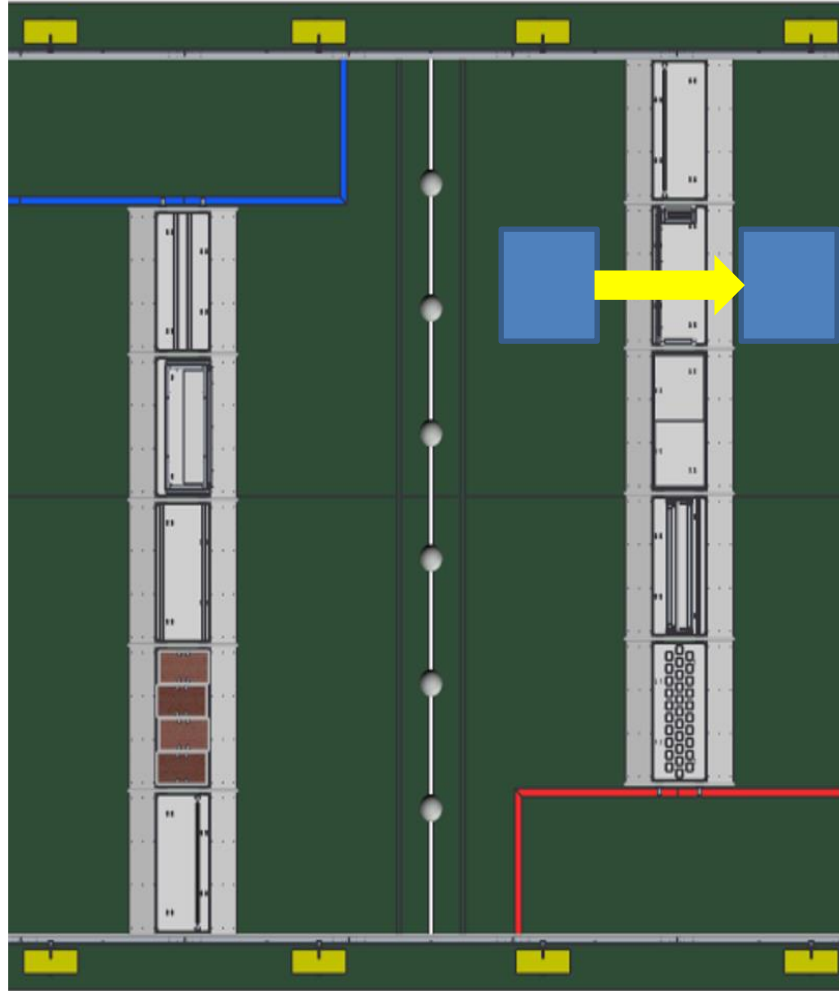
- not be in contact with a boulder staged on the midline
- confined to its starting configuration
- be fully contained by the opposite half of the field from their tower and breaking the plane of the auto line or inside the courtyard, in contact with the castle wall and guardrail. Only one robot per alliance, known as the “spy bot” is allowed to start each match in this position.

Game Play – Match Timing

- Match is 2 minutes and 30 seconds long
 - Autonomous period is 15 seconds at beginning
 - Teleoperated period is 2 minutes and 15 seconds long

Defenses and Strength

- Each defense starts with two strength
- Each time a defense is crossed by a robot, its strength is decreased by one
 - Robot starts free of contact with the defense and completely in the neutral zone
 - Robot traverses the defense such that its bumpers go fully between the adjacent shields
 - Robot ends up fully contained by the opponent's courtyard (must be clear that the robot has cleared the area)
- When the strength reaches zero, the defense is damaged
- Once four out of an alliance's five defenses have been damaged, the alliance's outer works are **breached** (Earns alliance one ranking point during qualification matches or match points during playoff matches)



The Tower

A boulder is scored in a goal if it passes through the opening of a goal and exits into the corral.

Each tower starts the match with eight strength. Each boulder scored in a goal decreases the tower's strength by one. A tower is weakened if the tower's strength is at or below zero. The strength of a tower is indicated by tower lighting.

A robot has challenged the tower if, at the conclusion of the match, the robot is fully supported by the tower, but hasn't met the criteria for scaling the tower.

The Tower

A robot has scaled the tower if, at the conclusion of the match, the robot:

- is in contact with a unique rung, and
- has all of its bumpers fully above the height of the low goals.

A tower is captured if, at the conclusion of the match:

- the tower is weakened, and
- the tower is surrounded such that each of the three opponent robots has scaled or challenged a unique face of the tower

(Robot has scaled or challenged a unique face of the tower if it is the only robot in contact with the attached rung and/or batter below).

Capturing the opponent's tower earns the alliance one ranking point during qualification matches or match points during playoff matches.

Point Values

Action	Auto	Teleop		Qualification	Playoff
Reaching a defense	2	-		-	-
Crossing an undamaged defense	10	5		-	-
Boulder in low tower goal	5	2		-	-
Boulder in high tower goal	10	5		-	-
Challenge (per robot on tower but not scaled)	-	5		-	-
Scale (per robot)	-	15		-	-
Breach (4 of 5 defenses at zero)	-	-		1 RP	20
Capture (3 robots at weakened tower)	-	-		1 RP	25

Penalty Assignment

- Upon a rule violation, a Foul will be assessed

Action	Penalty
Foul	5 points credited to opponent
Tech Foul	Foul + strength of opponent's tower is increased by one
Yellow Card	A warning – subsequent yellow card within the same tournament phase will lead to a red card
Red Card	Penalty assessed and a team is disqualified for the match
Disabled	Robot will be commanded to deactivate all outputs

Game Play – General Rules

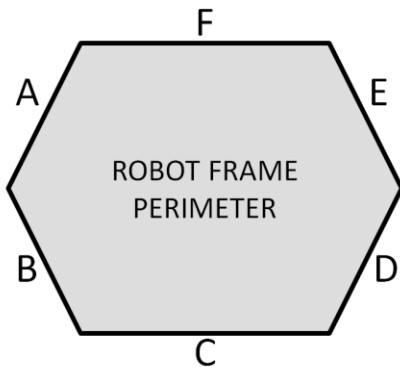
- Robot and team must follow safety rules
- The following actions are prohibited with regards to interaction with arena elements (exclude any defense, rungs, and boulders)
 - Grabbing
 - Grasping
 - Attaching
 - Grappling
 - Hanging
 - Becoming entangled
 - Damaging

Robot Rules

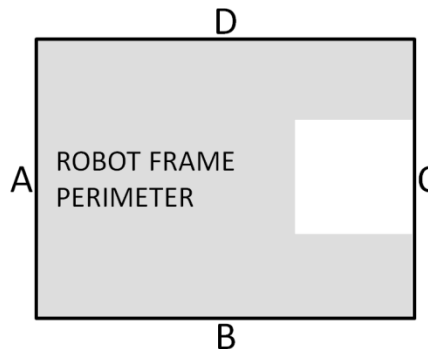
- Robot height, as measured when it's resting normally on a flat floor, may not exceed 4 ft. 6 in. during the match except during the final twenty seconds of teleop where there is no height limit when a robot is fully contained by the opponent's courtyard.
- Robots may not extend more than 15 in. beyond their frame perimeter.
- Robots may not intentionally detach or leave parts on the field.

Robot Rules

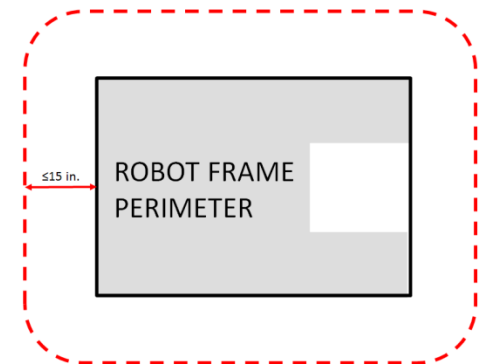
- Robot must have a frame perimeter, contained within the bumper zone, that is comprised of fixed, non-articulated structural elements of the robot.
- Robot must satisfy the following size constraints:
 - Total length of the frame perimeter sides must not exceed 120 in.
 - Must not extend greater than 15 in. beyond the frame perimeter, and
 - Robot starting configuration height must not exceed 54 inch.



FRAME PERIMETER LENGTH = $A+B+C+D+E+F \leq 120$ in.

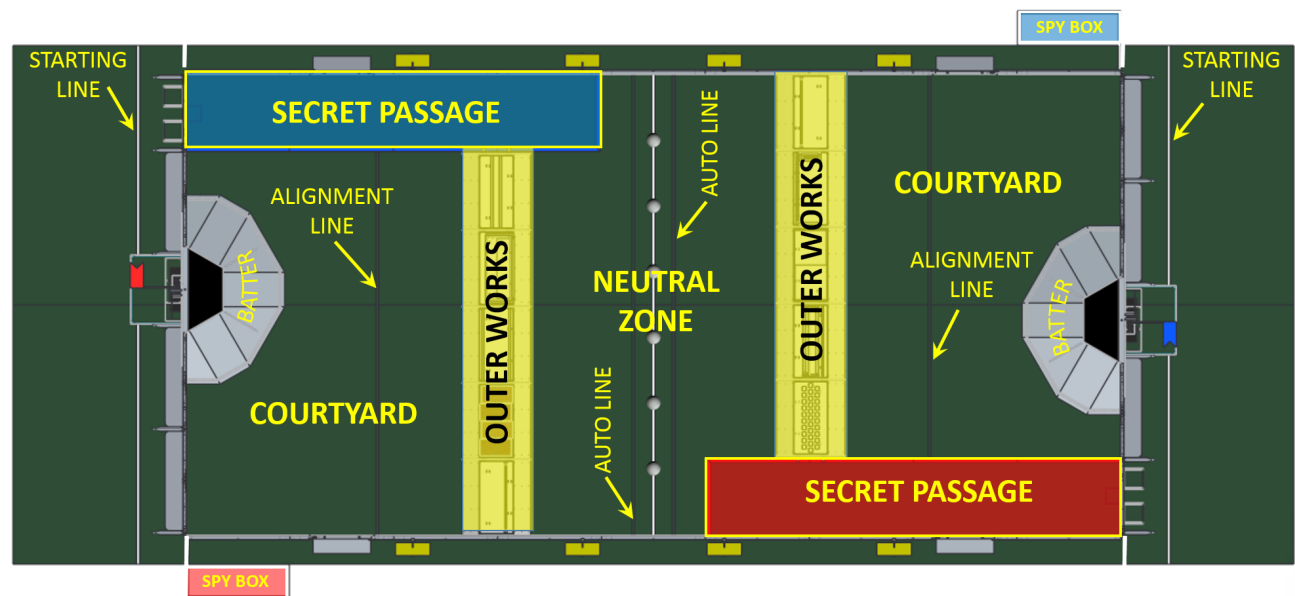


FRAME PERIMETER LENGTH = $A+B+C+D \leq 120$ in.



Robot Rules

- Robots may only enter or exit their opponent's secret passage from/to the opponent's courtyard.
- Robot contacting carpet in opponent's secret passage may not contact opposing robots
- Robots may not pin an opponent's robot for more than five seconds



Robot Rules

- A robot may not attempt to stop or impede the flow of the match:
 - Intentionally tipping over
 - Coordinating a blockade
 - Blocking goals while in contact with its own batter using anything outside its frame perimeter
- At any given time, only one robot may contact the carpet or batter inside their courtyard
- A robot may not transfer boulders from the neutral zone to the opponent's secret passage
- During the final twenty seconds of teleop, robots in their courtyard may not contact an opponent robot (the contacted robot is considered to have scaled an open side of the tower at the end of the match)

Human Actions

- During a match, drive teams may not use electronic devices which have the capability of receiving communications from persons outside of the castle
- Boulders may only be introduced to the field:
 - During teleop
 - By a driver or human player
 - Through one of the holes in the human player station
- No more than six boulders may remain in a castle at any time
- Coaches may not touch boulders unless for safety purposes

Boulders

- Robots may not control more than one boulder at any time
- Robots are prohibited from launching boulders unless they are in contact with the opponent's tower or carpet in the opponent's courtyard, and not in contact with any other carpet.
- A robot may not cause a boulder to mover from the neutral zone into the opponent's courtyard unless:
 - The robot contacts the boulder within outer works, and
 - The robot completes its crossing (doesn't go back into the neutral zone)

Boulders

- A robot may not cause a boulder to move from the neutral zone into the opponent's courtyard unless:

Examples meeting the requirements of this rule include, but are not limited to:

- A. A robot picks up a boulder in the neutral zone, and crosses a defense carrying the boulder
- B. A ROBOT, starting in the neutral zone, bumps a boulder through a defense, contacting the boulder within the outer works at least once. The robot then completes the crossing itself.

Examples not meeting this rule include, but are not limited to:

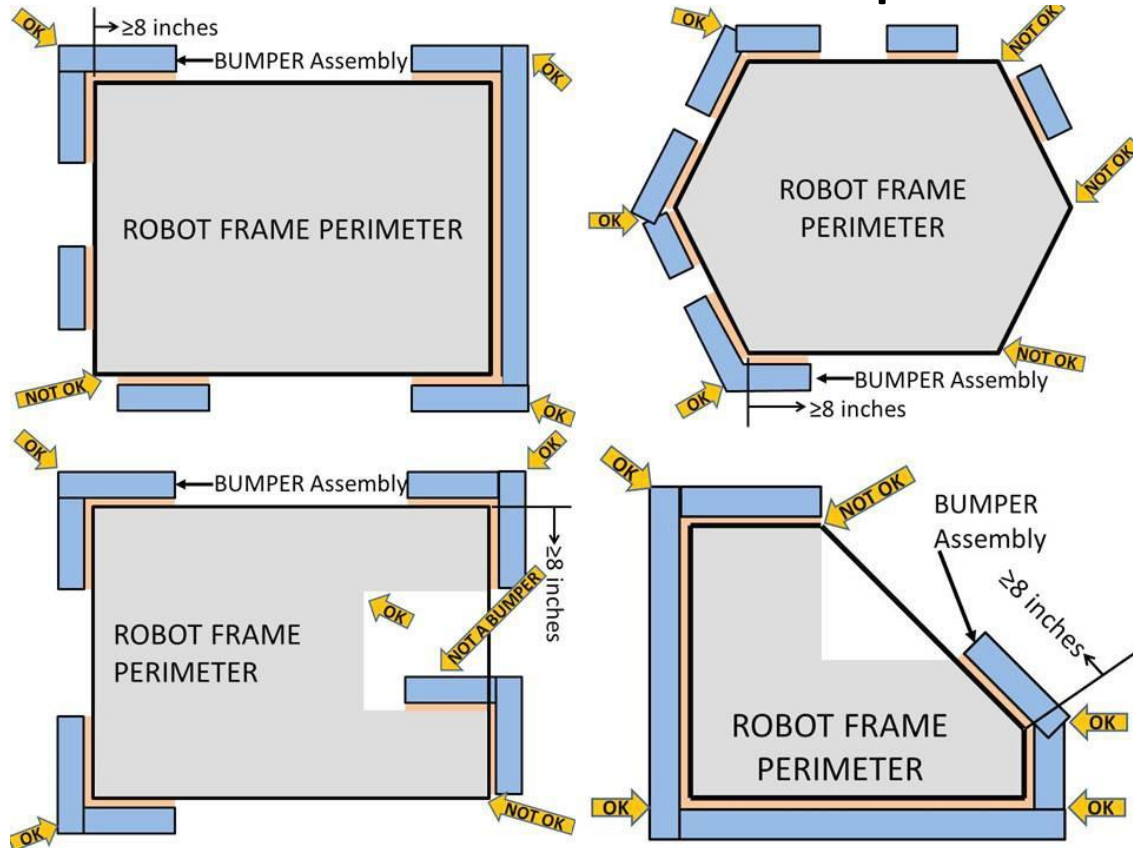
- A. A robot fully in the neutral zone lobs a boulder over a defense, then crosses a defense (this violates the rule because the robot did not contact the boulder within outer works)
- B. A robot fully in the neutral zone rolls a boulder over a defense, then crosses a defense (this violates the rule because the robot did not contact the boulder within outer works)
- C. A robot attempts to cross a defense with a boulder, drops the boulder so it rolls into the opponent's courtyard, backs fully out of the outer works to get a running start, then crosses a defense (this violates the rule because the robot completely backed out of outer works into the neutral zone)

Defense Rules

- Robots on the same half of the field as their alliance tower may not interfere with opponent robots attempting to traverse outer works (regardless of direction).
- A robot may not use the shield(s) to circumvent a defense.
- A robot may not pass completely over the low bar.

Bumper Rules

- Robots are required to use bumpers to protect all outside corners of the frame perimeter.



Considerations

- What is important to do?
 - For auto period scoring
 - For teleop period scoring
 - For making it into the Playoff round
 - For tie breaking in ranking points
 - For durability and reliability
 - To win engineering awards
- Form follows function:
 - Decide what function(s) we want to perform before deciding on what form to make the robot

Considerations

- What can be done so that the robots will be done in time to practice (five weeks)?
- Should we plan to use the camera?
- Are there certain defenses we always want to be able to cross?
- Think about how you would do it if only humans played
- What is impact of limited size restrictions?

Considerations

- What worked well in the past that we should repeat?
- What didn't work well in the past that we should avoid?
- What can be programmed?
- For building three robots?
- What do we know how to do?
- What can be done effectively?

Considerations

- Based on scoring and tie breaking, what are two or three key strategies:
 - Ability to maximize elimination round points
 - Autonomous programming for mobility or scoring
 - Ability to collaborate with Alliance partners
- Take enough time to know what we want to do (knowing why we want to do it) before we decide how to do it.

Input from Kettering University

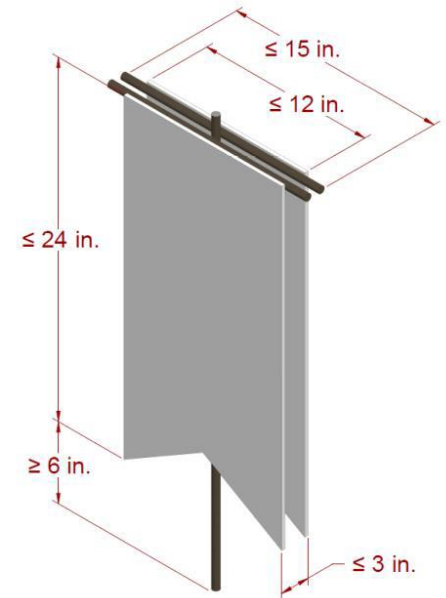
- Small group went to Kettering University this morning for a design review.

Key Dates

- Robot Bag and Tag date is:
 - February 23, 2016 at 11:59 PM

Other consideration

- Team standard
- Theme opportunity for drive team
- Theme opportunity for pit structure



Strategy and Design Development

1. Taking next couple of days to “think about the problem” before we solve the problem.
2. All engineering team leaders are also on the Strategy Team and will be involved in the strategy development in the next week.
3. Today we are gathering information from what we know today.

Design Selection

- After input reviewed and input from various teams, Game Strategy and Scouting team, etc.:
 - Design selection committee:
 - Mr. Cesiell, Mr. Savage, Mr. Drummer
 - Brendan Treanore, Vishnu Regaraj, Lucas Beutler, Leo Gomez, Dylan Anthony

Strategy Discussion Groups

1. Select someone to be spokesperson for group reviews and someone to document your findings
2. List what is important to do and why
3. Also list what we do not need to do and why

DO NOT TRY TO DESIGN A ROBOT – THIS IS A STRATEGY DISCUSSION ONLY!

Strategy Discussion Groups

1. You have until 4:00 PM to prepare for review
2. Include breaks
3. At 4:00 PM, we will go around the room and have each team present their items
4. When done, we need to clean up the room as if we were never here

GOOD LUCK!