Performance Cricket Footwear Focusing on Foot lockdown, Cushioning, Traction, and Impact Protection

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SPD 610, 688 & 689

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Professional Statement

Top 5 strengths based on Strengths Finder

- Learner
- Discipline
- Empathy
- Achiever
- Ideation

Golden Circle

To help athletes perform better, how could we design cricket shoes for two-player positions: bowler and batter that helps with heel and ankle stability and equal distribution of ground reaction forces (cushioning) upon landing in fast bowlers and lateral support, better traction, and protection against the ball for the batter?

WHY?

Help athletes perform better and spread knowledge about the game as much as possible.

HOW?

By designing a set of beautiful, functional, and innovative footwear.

WHAT?

A set of footwear for two different player positions: Bowler and Batter

How do my strengths support my thesis and future career in the industry

My thesis topic is a design opportunity in a unique space with fewer products in the market than in other sports areas. This allows me to go above and beyond in creating designs to achieve their most significant limitation that helps athletes perform better. Having grown up watching this sport and playing it on a recreational level, I have strong empathy toward the

athletes, as I am aware of their struggles and pain to perform at the highest possible level. This empathy will be reflected in the designs of my thesis project.

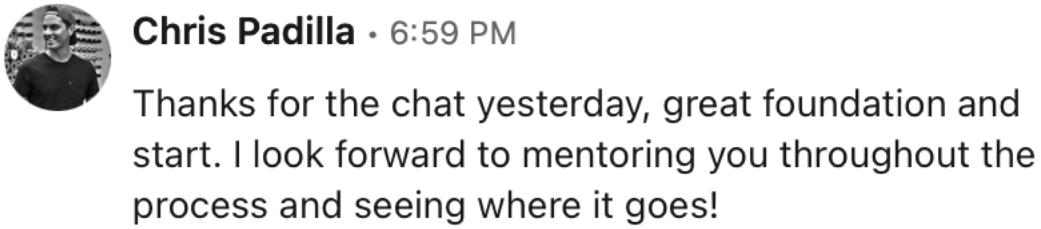
I am incredibly passionate about footwear design and hope to work in the sports footwear industry upon graduating, as I want to create innovative, functional, meaningful, and impactful products. As mentioned earlier, I am very familiar with Cricket, and my love for this sport has always been there. Through this thesis project, I have decided to combine my love for this sport and my passion for footwear design, which will help me get a job in the industry I am passionate about.

Industry Mentors

Chris Padilla, Sr. Footwear design concept lead at Adidas

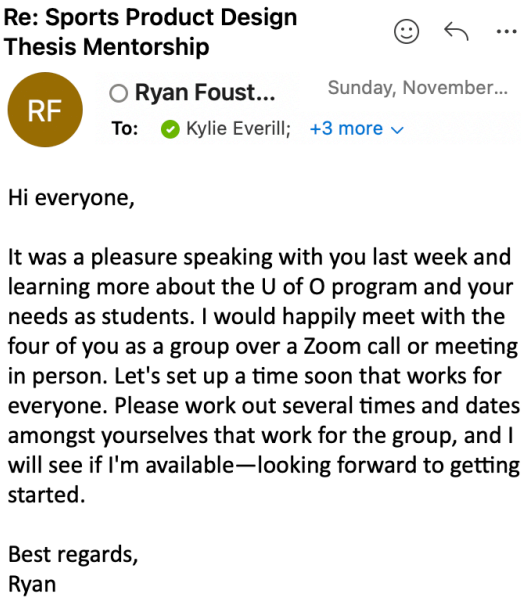
(Mentorship status: Confirmed)

Meeting plan: Meet virtually on zoom once every two weeks to discuss the progress and get feedback which will reflect in the following week's work and add towards building up a great thesis project. I have already met with Chris on zoom and have shown him my thesis presentation that we have been presenting in class. He is super interested in mentoring me throughout the thesis project timeline.



Ryan Foust, footwear designer at Bass Pro

(Mentorship status: Confirmed)



Re: Sports Product Design Thesis Mentorship

RF

Ryan Foust... Sunday, November...

To: Kylie Everill; +3 more

Hi everyone,

It was a pleasure speaking with you last week and learning more about the U of O program and your needs as students. I would happily meet with the four of you as a group over a Zoom call or meeting in person. Let's set up a time soon that works for everyone. Please work out several times and dates amongst yourselves that work for the group, and I will see if I'm available—looking forward to getting started.

Best regards,
Ryan

Project Overview

This capstone project for the Sports Product Design program at the University of Oregon focuses on developing two performance footwear for player positions, Bowler and Batter. Thorough research of player positions, current market products, the sport's rules, biomechanics, and foot movements of the players have been conducted.

Cricket has been around for centuries since the 1500s. Among 104 nations that are a part of the International Cricket Council has recognized it as one of the world's most popular sports. Among all the nations, Cricket is the most profitable in India. They conduct the Indian Premier League, commonly known as IPL, every year and draw huge attention and business. According to advertising media company Group M, the IPL made $1 billion in sponsorship money in 2017 compared to the $892 million Major League Baseball made in sponsorships in the same year. (Why Cricket is worth $5.3 billion - in just one country, 2018)

Among all the countries, Cricket is widely popular in India, Australia, Pakistan, England, and Sri Lanka, to name a few. This project aims to design performance footwear for these players through thorough research, creativity, and testing to help these players perform better, along with educating the masses about Cricket.

User Profile

The user group for this project is professional male cricketers between 20-30 years old playing on pro-level. The two focused player positions are bowling and batting.

Jobs to be done

Bowling

The ball must be propelled overhand for a proper bowling delivery without bending the elbow. The bowler may run any desired number of paces during each bowling delivery. The goal of a bowler is to make the batsman out and prevent the other team from scoring as high runs as possible. The two major requirements of a good bowler are the ability to pitch (bounce) the ball on the desired spot, which is usually at or slightly in front of the batsman's feet, and the command of direction. (Williams & Alston, Britannica, n.d.)

Batting

The batter is responsible for scoring as high runs as possible when it is their turn to bat. They must seize upon the wrong deliveries from bowlers and always protect their stumps. (Realbuzz, n.d.)

The two chief strokes in batting are a forward stroke when the batsman advances his front leg to the pitch, and a backstroke when the batsman moves his rear leg back before playing the ball. (Williams & Alston, n.d.)

Product Classification

The project will focus on developing two different footwear styles for two-player positions in cricket, a Bowler, and a Batter, as each has different footwear needs and considerations. The general problem to solve would focus on better traction, the right amount of cushioning, heel and ankle stability for the bowler and better traction, protection against the ball deliveries that target the foot of the batter, as well as lateral support for Batters.

Focused Market: International

The footwear designed for the Bowler and the Batter will be made for the international market as the user-focused group for this project is male cricketers playing on the pro level from different nationalities such as the USA, Australia, England, India, and South Africa.

There are roughly 4,200 professional cricketers in the world. However, approximately 30 million registered players, including entry-level and pro athletes, are estimated to play the sport based on experience and expertise. (Smith, 2022) The global cricket market covers equipment such as bats, balls, protective gear, footwear, and apparel. India is the largest market, with a share of about 60%, followed by the UK and Australia, with a share of 30% combined. The global cricket market size in 2021 was estimated at USD 330.36 million and is predicted to reach USD 374.40 million by 2028 and exhibiting a compound annual growth rate of 1.80%. (TheExpressWire, 2022) It is estimated that the advancements in technology in cricket equipment and the introduction of eco-friendly products will lead to a sizeable demand in the market. (Global News Wire, 2022)

Asia-Pacific dominates the Cricket equipment and footwear market today due to the rise of the sport in this area. Furthermore, it is predicted that some key players will boost the growth of the Cricket equipment market. Europe is to observe significant market changes due to an increase in the investment made in this sport. Also, the rise in the number of several Cricket

tournaments is further anticipated to propel the growth of the Cricket equipment and footwear market in multiple regions in upcoming years. The current market is segmented on product type, which includes Cricket equipment such as bats, balls, Pads, stumps, bails, kits, footwear, and apparel, as well as the end user, along with distribution channels such as hypermarket or supermarket, specialty stores, and online sales channels. (Data Bridge, n.d.)

Problem Statement

How could we design cricket shoes for male cricketers playing two different player positions: bowler and batter that helps with heel and ankle stability and equal distribution of ground reaction forces (cushioning) upon landing in fast bowlers and lateral support, better traction, and protection against the ball for the batter?

Introduction to Cricket

Cricket is played with a bat and a ball and involves two competing teams that comprise 11 players in each group. The sport is played indoors and outdoors. Outdoor cricket is played in oval stadiums or fields with a rectangular area in the middle called a pitch. The pitch is 20.12 meters long and 3.04 meters wide. Prominent playing takes place within this pitch. On both ends of this pitch are two sets of three wooden sticks called wickets set inside the ground. On the top of these wickets are horizontal pieces of wood called bails. Both these teams take turns batting and bowling, and each turn is called innings. In a game format, there can be multiple innings. (Longmore A., 2021)

The bowlers deliver the ball with a straight arm and try to break the wicket (hit the wicket) with the ball, so the bails fall off, and the batsman is out. A bowler delivers six balls at a time which is called an over. Once a bowler has completed his over, another member of the same team starts the next over. The job of the batting side is to defend the wickets, prevent the bails

and wickets from falling, and score the maximum runs possible. The batters can decide to run within the rise to score runs depending on the distance the ball is being hit. A hit may be defensive or offensive. A defensive impact may protect the wicket but leave the batsman no time to run to the opposite wicket to score runs. If the batsman makes an offensive hit, he and the second batsman (non-striker) can decide to switch places by running across the pitch. (Longmore A. A., 2021)

Each time both batsmen can reach the opposite wicket, they score one run. Providing they have enough time without being caught out and dismissed; the batsmen can continue to run additional surrounds to score more runs. The cricket field has a boundary. If a batter hits the ball at the border or if it hits the ground and goes beyond the boundary edge, the team scores four runs. The team scores six runs if the batsman hits the ball directly outside the boundary without touching the ground. The team with the highest number of runs wins the match. It is common for a batter to score 100 runs or more alone. Here it is called the century. (Longmore A., Cricket - Sport, 2021)

Besides the 11 players of each team, the match also has two umpires on the field who control the game as the laws require, with absolute impartiality. Both the umpires are on the ground and report to the ground executive at least 45 minutes before the scheduled start of each day's play. The referees do not change during the match except in exceptional circumstances (Law 2 - The Umpires, n.d.). The game always begins with a toss. If the outcome favors one captain, he decides whether his team will bowl or bat first.

Figure 1: Cricket stadium (Yadav, 2018)

History and Evolution of Cricket

It is believed that Cricket might have begun possibly as early as the 13th century. It was initially considered a boy's game, where the country boys bowled at a tree stump or the hurdle gate into a sheep pen; until the 17th century, the ball was a stone and remained the same. The primitive bat was a tree-shaped branch that resembled the modern hockey stick but was longer and heavier. The evolution of the shape bat into a straight bat was made to defend against length bowling, which grew with cricketers in a village in Southern England. The bat was later shortened in the handle and straightened and broadened in the blade, which led to forward play, driving, and cutting. Although there is little information on the game's ancient history, it is believed to have been a children's game until 1611. In 1671, the future Lord Protector of England, Oliver Cromwell, at 18 years, was the first person to be mentioned as playing Cricket in London, during which village cricket was popular. In the 18th century, Cricket was popular enough to grow from teams representing villages to groups representing entire countries. Throughout the 18th century, the popularity of Cricket increased tremendously in England and slowly started expanding to different countries. (Beyer, 2022)

At the beginning of the 19th century, Cricket appeared in the records of many parts of the British Empire, such as Barbados (1780), Canada (1785), Australia (1804), and South Africa

(1808). The British were stationed in India and slowly started setting up cricket clubs there. In Australia, Cricket started gaining popularity, and the first test was played between Tasmania and Victoria in 1850. In Canada, Cricket was first played on an organized basis in 1834, after they formed a club in Toronto. A team from Toronto played against clubs from New York. In 1844, the first international cricket match was played between Canada and the United States at St. George's Cricket Club in Manhattan, New York. In South Africa, the first domestic Cricket started in 1876. British sailors introduced Cricket in India in the early 1700. In the early 1900s, Indian players played for English cricket teams until 1912, when the Indian group officially toured England for the first time. In 1926, India was invited by the International Cricket Council to join the organization, and in 1932, they played their first official International Test against England. (Beyer, A History of Cricket: The World's Second - Most Popular Sport, 2022)

As Cricket was spreading across the globe, it underwent multiple inventions and changes throughout its journey to date. They invented the first batting pads in 1836 to protect the batters' legs. Wicket-keeping gloves were first used in 1850, making catching easier for the wicketkeeper. Helmets were first used in the sport in 1930, which provided added safety to the batters from the hard leather ball. (Sheehan, n.d.)

The first ever One-Day International (ODI), played over 50 overs, was played between Australia and England in Melbourne in 1971. Soon four years, they played the first cricket world cup in 1975, held in ODI format between West Indies and Australia. After that, the tournament gained popularity and was soon conducted every four years, with preliminary qualification rounds leading to a final match. (Sheehan, The History of Cricket, n.d.)

Three Formats of Cricket

Cricket is played in three main formats. The three formats are Test matches, One-Day Internationals, and Twenty-Twenty or T-20 Internationals. Most of the rules remain the same in all these three formats. However, the significant difference lies in the game's duration and several overs and innings played. All these three types of matches are played under the rules and regulations of the International Cricket Council. (International Cricket Council (ICC), 2020)

Test cricket is the oldest and most traditional game form, which has been played since 1877. It is a 5-day game format that comprises two innings. Both teams must exhibit endurance, technique, and temperament in different conditions to perform well in the game's structure. One-Day Internationals, also known as ODI, is a relatively faster cricket format that started in 1971 but gained popularity in the 1980s. This format comprises one inning of 50 overs per side in which both teams show techniques, speed, and skills. The most popular game ICC Cricket World cup is conducted in this format every four years. The Twenty20 Internationals, or T-20, is the game's newest, shortest, and fastest form. This format comprises 20 overs played by each team since its advent in 2005. The Twenty20 International match lasts three hours and comprises huge hitting, skillful bowling, and fantastic fielding. (International Cricket Council, 2020)

The Basic Setup of the Cricket Field

The cricket field is shaped oval and is divided into two halves, the off-side, and the leg-side. During a game, there are 11 fielders placed at unique positions on the field by the captain of that team, two batters from the opposite team, and two umpires whose job is to ensure the gameplay is fair. Only two members of the fielding team are set in positions at any point of the match. The bowler delivers the ball from one end of the pitch, and the wicketkeeper from the same team is on the opposite side behind the other team's batter. (Harris, 2022)

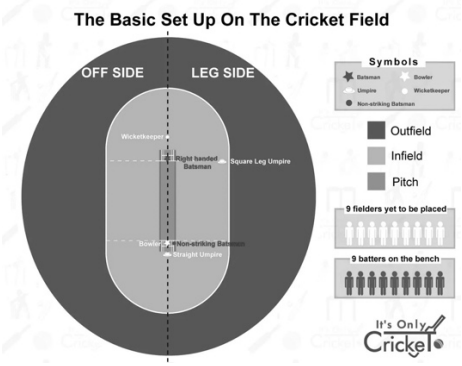


Figure 2: The basic setup on the cricket field (Harris, It's only cricket, n.d.)

The two hemispheres of the cricket field are known as the leg side, sometimes called on-side and off-side. The captain of the bowling and the fielding team decides which player will be at a specific position on the field. However, the captain is free to stand wherever they like, but because of the need for consultation, they usually position themselves as close as the bowler. Each fielding position can also be named based on the distance from the batter. The five most common terms for these positions are: silly, short, mid, deep, and long.

Main Player Positions in Cricket: Batting

Batting is not about hitting the ball as far as you can or just scoring runs but to excel as a batsman in the sport, one needs to have a good stance. Batting stance is the position the batsman gets into as the bowler is about to make a delivery or any movements just before the bowler has released the ball. An ideal batting stance is a comfortable, balanced position one must get in to make various shots when the bowler makes any delivery. (Luke, 2020)

Figure 3: Indian national cricket team batters (Nanda, Crick Academy, 2020)

There are three essential components for being a good batsman: Gripping of the bat, the stance of the batsman, and back lift of the bat while batting. The gripping of the bat is the way the player holds the bat. It is the most critical factor for being a good batsman, as this determines how the player will hit the ball on the delivery from the bowler. One way of gripping the bat is to make a 'V' shape between both hands' thumb and index finger. The other way of engaging the bat is holding it straight upward such that the thumb covers the middle portion of the bat and then placing the other fingers at the edge of the bat. (Nanda, Basics of Batting in Cricket: Techniques & Tips, 2020)

Having a perfect stance during batting helps the batsman adjust the movement of the leg and the body with the pitching of the ball. It also helps distribute the body's weight evenly on both legs. The batsman's injuries can often be because of an improper batting stance. (Nanda, Basics of Batting in Cricket - Techniques & Tips, 2020)

The best batting stance is where the batsman has aligned themselves in a side-on position with their front shoulder pointing towards the bowler. The feet must be about shoulder-wide apart, and the knees must be slightly bent. The back should also be bent, allowing the batter to

bat on the ground near their feet. At the hip height, the hands should be close to the body. Only sometimes, one batting stance suits all the batters. Some batsmen follow the traditional stance; however, some have unique perspectives. The most successful batters in the world have a particular posture, and they still play well and score high runs. (Luke, What Is the Best Batting Stance in Cricket? 2020)

The back lift of the bat is another primary skill the batter must get right to play well. It is the most vital role for the batsman because the shots they deliver depending on the angle of the movement of the bat. The batter should lift the bat when the bowler is in action. Any time delay in raising the bat can cause misjudgment of the ball. The bat should be lifted at an average height, i.e., not too low nor too high. A high lift may take a specific time to reach the ball's pitching, and a standard back charge will restrict the batsman from driving the ball smoothly. (Nanda, Basics of Batting in Cricket - Techniques & Tips, 2020)

Batting Order and Positions

Opening Batsman

The opening batsman is the one that goes first on the field to bat; however, they might only sometimes be the best among all batters. The two opening batsmen must face the new ball, which can swing more and provide more movement off the seam. Therefore, they must be more patient, keeping their wickets intact as they ‘see off the new ball.

(Harris, Batting Order In Cricket: How Is A Batting Strategy Set Up?, 2022)

Figure 4: Greatest Indian opener, Saurav Ganguly (Harris, It's Only cricket, n.d.)

Top Order Batsman

The top-order batsman usually goes third or fifth in the whole lineup. If the opening batsman loses a wicket early in the game, these top-order batsmen may face the new ball. The team's best batters can be included in the top-order list. (Harris, Batting order in cricket: How is a batting strategy set up?, 2022)

Figure 5: Joe Root, top order batter (Matt Harris, n.d.)

Middle Order Batsman

These batsmen usually go at number six or eight in the lineup. They are generally referred to as all-rounders as they can bat and bowl. Numbers seven and eight are all-rounders unless number seven is also the wicketkeeper. They play different roles depending on the game. For example, if the team has already scored high runs when they come in, their job would be to

accumulate runs at a quick pace and build on that total. Alternatively, if they come in when the team has scored low, they would need to merge and not play risky shots such as hitting four or sixer and lift that total at a slower tempo. (Harris, Batting Order In Cricket: How Is A Batting Strategy Set Up?, 2022)

Figure 6: Tasmanian middle-order batsman Tim Paine (Harris, It's Only Cricket, n.d.)

Lower Order Batsman

They are also often called tailenders. They usually play at number 9 in the lineup or also sometimes at 8. They are on the side for their bowling, and any runs they score are typically considered a bonus. (Harris, Batting order in cricket: How is a batting strategy set up?, 2022)

Main Player Positions in Cricket: Bowling

A bowler's job is far more physically intense than the batter's. Players must determine which bowling style suits them best to become good bowlers. The bowler's priority task should be to get the batter out. The two primary essential factors for bowling are length and direction. Secondary factors followed them, such as pace, flight, spin, swing, etc. Also, the ball should be grasped in the fingers and not the palm. The goal of the bowling action is to enable the release of the ball from a comfortable and well-balanced position where maximum efficiency is obtained

from the coordination of the fingers, wrist, arms, shoulders, and body. The run-up action should be of a precise length that is not too short or too long. The run-up need not always be straight; it can also be angular. Almost as many right-handed bowlers often place their right foot parallel to the bowling crease during their delivery stride. The left arm gets pushed upwards while the weight is transferred onto the right foot of the body, making the body lean backward. The left leg gets slightly raised off the ground during the delivery because of the 'winding of the bowling action. (Umrigar, n.d.)

There are two main types of bowlers in cricket: Pacers (also known as fast bowlers) and Spinners. They can be further divided into fast bowlers and swing bowlers in the spin bowling department, wrist spinners, and finger spinners in pacers. Fast bowling has multiple variations, including Bouncer, Outswinger, Inswinger, Reverse Swing, Leg and Off-Cutter, Yorker, and Slower Ball. On the other hand, Spin bowling includes Leg Break and Off–Break, Googly (Leg Spinner), Doosra (Off Spinner), Top Spinner (Leg and Off Spin Bowling), Carrom Ball (Off-Spin Bowling), Slider (Leg Spinner), and Arm Ball (Off Spin Bowling). (Umrigar, Bowling-length and direction, n.d.)

Bouncer

It is one of the most dangerous deliveries in cricket. In this type of bowling, the ball is pitched short. Since it is one of the most hazardous bowling, the rules for bouncers have been changed multiple times. In ODIs and T20, the bowlers can only bowl two bouncers in an over. (Parag, Types of Bowling in Cricket: A - Z guide for fast and spin bowling, 2019)

Figure 7: Pace bowling, bouncer delivery (Pagar, kreedon.com, 2019)

Outswinger and Inswinger

Outswinger is a perfect setup for the right-handed batsman in test cricket. Outswingers force the batsman to chase the ball to the edge. Right-arm bowler to the right-handed and left-arm to a southpaw is the perfect setup for outswinger deliveries mainly because of the angle they create while going away from the batsman. Like outswingers, inswingers are also pitched on a suitable length but are challenging to master. (Parag, Types of Bowling in Cricket: A - Z guide for fast and spin bowling, 2019)

Figure 8: Inswing bowler (Pagar, Kreedon, 2019)

Reverse Swing

In reverse swing bowling, the ball takes a more swing than a normal one and takes place much later in the delivery, making it challenging for the batsman to identify. It is also one of the most complex types of bowling to master. (Parag, Types of Bowling in Cricket: A - Z guide for fast and spin bowling, 2019)

Figure 9: Reverse swing bowling delivery (Pagar, Kreedon, 2019)

Leg and Off Cutter

The leg-cutters and off-cutter delivery are slower deliveries bowled with fingers rolled over to the leg side, generating the spin. The right-arm bowlers use their index fingers to spin the ball towards the leg side, and vice versa applies to the off-cutters. (Parag, 2019)

Figure 10: Leg cutter and off-cutter bowling delivery (Pagar, Kreedon, 2019)

Yorker

Yorker deliveries are the most difficult ones to master and leave no space for error. In this type of delivery, the bowler bowls the ball aimed toward the batsman's feet, making it difficult for the batsman to hit. (Pagar, Types of Bowling in Cricket: A to Z guide for fast and spin bowling, 2019)

Figure 11: Yorker delivery by Jasprit Bumrah (Pagar, Kreedon, 2019)

Slower Ball

A slower ball is a stock delivery bowled at a much slower speed than an average pace of a fast bowler. In this type of delivery, the batsman usually turns up playing the ball too early and turns to hit the ball high in the air, which can be easy to catch for the fielding team. This type of ball delivery is picked up from baseball. (Pagar, Types of Bowling in Cricket: A to Z guide for fast and spin bowling, 2019)

Figure 12: Slow bowler (Pagar, Kreedon, 2019)

Leg Spinner and Off Spinner

In this type of delivery, the spin is the 'wrong' direction for the leg spinner. Unlike the off-break delivery, in this spinning, the bowler uses their wrist to generate a sharp turn for the ball when the delivery has been made. In off-spinning delivery, the ball spins from the leg side to the offside. (Pagar, Types of Bowling in Cricket: A to Z guide for fast and spin bowling, 2019)

Figure 13: Off-spinner Muttiah Muralitharan (Pagar, Kreedon, 2019)

Carrom Ball

This ball delivery is mainly about how it is held in hands and thrown. The ball is held with the thumb, index, and middle finger. It is then released by flicking the fingers like a carrom player. Also, the ball's spin depends on how the ball is held. For example, if the middle finger points towards the offside, the ball will spin from off to leg side and vice versa. (Pagar, Types of Bowling in Cricket: A to Z guide for fast and spin bowling, 2019)

Figure 14: Carrom ball delivery (Pagar, Kreeodn, 2019)

Arm Ball (Off-Spin Bowling)

This type of bowling delivery is the off-spinner's variation of a slider in which the bowler bowls straight instead of spinning the ball in any direction. (Pagar, Types of Bowling in Cricket: A to Z guide for fast and spin bowling, 2019)

Figure 15: Off-spin bowler, Ravindra Jadeja (Pagar, Kreeodn, 2019)

Main Player Positions in Cricket: Wicketkeeping

The wicketkeeper plays a vital role in the fielding and bowling team. His position lies behind the striker's wicket. The wicketkeeper usually stands 10–20 yards behind the wicket if the bowler is a fast bowler or directly behind the door if he is a slow-paced bowler. The reason this player position is highly essential is that it is their job to concentrate on the ball to stop the ball that passes the wicket and stump the batsman if he leaves his place or to receive a ball thrown at him by the fielder so that he can stump the batsman out if they are taking any runs in between and cannot return the stump line. (Strategy and technique, n.d.)

Figure 16: Wicketkeeping in cricket (Narayanan, 2013)

Main Player Positions in Cricket: Fielding

Fielding plays another crucial role in cricket. The team that is bowling to the opposite team takes this role first. Various activities in fielding are catching the ball without letting it drop on the field and collecting and returning the ball when the batsman has hit it. There are nine players on the team engaged in fielding while one is bowling, which takes turns after completing

one over, and the 11th player is the wicketkeeper. One of the crucial roles of the fielder is to minimize or stop the batters from scoring runs. To fulfill this task, the fielder needs to make sure that they get hold of the ball as quickly as possible and returns it to the wicketkeeper so that he can prevent the batters from scoring more runs. Another vital role of the fielder is to catch the ball midair in play after it has been hit and before the ball touches the ground. (Cricket Movement: Fielding, n.d.)

Sport Environment

Cricket is a summer sport usually played outdoors, with many international matches across different continents, such as Europe, Asia, and Australia, which have other climate conditions throughout the year. In most cases, the climate tends to be hot and humid during matches, affecting the game and the player's health differently. Also, many cricket-playing nations are in areas that are most vulnerable to climate change. During Test Cricket, where the matches last for days, the players are attired in long-sleeved shirts, trousers, padding, and helmet. Cricket is also one such sport where the weather significantly affects the nature of the game and the playing surface. At one moment during the match, it can be sunny, and the next minute, it can be overcast with humid conditions. (Lavalette, Cricket's Climate Change Dilemma, 2019)

In 2020, the dangers of heat stress in Sydney, Australia was magnified when England's Captain, Joe Root, could match only for an hour during the five days of Test Cricket. At one point, the temperature rose to 57.6 degrees Celsius in the middle of Sydney Cricket ground. To prevent such issues in the future, in Australia, the cricket board has introduced a heat policy which leads to the enforcement of extra drink breaks or even suspension of leaves if the temperatures rise too high. The drastic temperature increase can put the player's health at risk.

These players must be protected against heat stroke and more lasting skin cancer damage. (Lavalette, Cricket's Climate Change Dilemma , 2019)

Figure 17: Joe Root retires unwell due to cricket's heat policy (Lavalette, Forbes, n.d.)

Effect of Weather Conditions on the Game

The weather conditions play a massive role in determining the result at the end of the match. During the toss, most of the time, the climate and the current weather conditions are significant considerations for the captain to make a good decision of bowling or batting first. Good weather conditions and clear skies with a decent amount of sunlight favor the batters as it helps them score more runs. However, on the other hand, slightly overcast and humid conditions are favorable to the bowler. (How Weather Conditions Affect The Match, n.d.)

If the weather conditions are good, with clear skies, it is favorable to the batsman because, in such situations, the ball does not swing much. If the sun is beating hard at the pitch, it removes all the moisture from the angle. This is highly favorable to the batsman and allows them to hit the ball and score more runs quickly. Also, if the conditions are warm, the grass dries out quickly, which helps the batsman in scoring runs. On the other hand, if the weather conditions are cloudy and overcast, it favors the bowler. Especially for fast bowlers, it is highly favorable because some believe that the ball tends to swing more during these conditions. Hence, increasing the chances of getting the batsman out. In case of rain or high humidity levels, it is

again in favor of the bowlers. In addition to the pitch, the ground also gets wet, which slows down the speed of the ball. Also, sometimes the ball gets slippery, making it more challenging for the bowlers to grip it. This is a common phenomenon, especially during day-night games where the dew causes problems for the bowling and batting teams during the second innings of the match. (How Weather Conditions Affect The Match, n.d.)

Rules of Cricket Specific to Bowling and Batting

Bowling

Bowling can be a right or left arm. A bowler must complete an over of 6 balls at a time. If the bowler has bowled an illegal delivery, it is termed as no ball; if he bowls outside the reach of the bowler, it is termed as a wide ball. The ball must be propelled over the hand to make a proper delivery without bending elbows. Before the delivery, the bowler may run any desired pace and length within certain boundaries, such as not crossing the popping crease.

In some cases, depending upon the delivery of the ball, it hits the ground (pitch) before it reaches the batsman, but it is not a requirement. Although the first requisite for a good bowler is the command of length which is the ability to pitch the ball at the desired spot, usually at or slightly in front of the batsman’s feet. However, this depends on the bowler's pace, the pitch's state, and the batsman's reach and technique. The second requisite is the command of direction in which the bowler may elaborate with variations such as finger spin, swerve, and alteration of pace that lends deceptiveness and uncertainty as to exactly where and how it will pitch. The bowler must wear full spiked shoes, but extremely fast bowlers prefer hoes with higher ankles, more cushioning, and ankle straps. If a bowler can deliver at a speed greater than 85 mph (135kph), he can achieve reverse swing, which means that without altering the grip on the ball or the delivery motion, the bowler can cause the ball to swing (curve) in two directions. This, in

turn, makes it difficult for the batsman to gauge the direction in which the ball will move. If the bowler does not have the speed or the pace required to deliver the ball in reverse swing, the bowler can scratch or scruff the ball's surface against his pants to make that delivery. (Marcus K. Williams, Strategy and Technique, n.d.)

Batting

Like the bowler, the batter can hit right-handed or left-handed. Good batting is based on a straight bat with its flat side facing toward the ball. The batsman uses half-spiked shoes. They remove the spikes from the heel for better front-foot and back-foot switching. It is considered four runs if the batsman hits the ball to the boundary along the ground.

On the other hand, if he hits the ball over the border, it is considered six runs. If the batsman hits the ball not too far, he can run between the wickets, in which one full length of the pitch gives him one run. Some chief strokes in batting are forward stroke, in which the batsman puts their front leg towards the rise, i.e., towards the direction of the ball, and plays it in front of the wicket; a backstroke is where the batsman moves their rear leg back before hitting the ball; a leg glance is a stroke in which the ball is deflected behind the wicket on the leg side; a cut is where the batsman hits the ball on the uprise, i.e., after it has hit the ground on the off side; a pull or hook is another stroke in which the batsman hits the ball on the uprise through the leg side. (Marcus K. Williams, Strategy and Technique, n.d.)

Current Market and Footwear Considerations

Finding the correct cricket shoe is time-consuming and usually requires much research. These currently available cricket shoes offer much-needed support to the feet and protect the players against injuries. They are equally crucial for batters and bowlers as well as all-rounders. A perfect pair of cricket shoes can help the batsman improve his posture and stance to face the

incoming ball. On the other hand, the right pair of shoes help bowlers land perfectly and stabilize their hands. Lastly, they help fielders run faster and provide balance. (How to select the right cricket shoes for your game?, n.d.)

There are specific design considerations for buying a new cricket shoe:

Material

Shoes built with high-quality material on the upper surface, such as Polyethylene (PU), Microfiber, or high-quality synthetic material. (How to select the right Cricket shoes for your game?, n.d.)

Cushioning

Cushioning is one of the most important factors to consider while buying a cricket shoe, as most cricketers will run 2-5km in a single match which exerts much pressure on their lower legs. The proper amount of cushioning will reduce this force on the lower legs. The heel and the midsole are the ideal places where cushioning is needed the most. (How to select the right cricket shoes for your game?, n.d.)

Stability

Alongside cushioning, stability is another critical factor to consider while buying cricket shoes. Some manufacturers offer medial arch support to help in the reduction of pronation during bowling. It also results in reduced forces which are experienced on the inner ankle, knee, and hips. (How to select the right cricket shoes for your game?, n.d.)

Ventilation

The foot must breathe during an intensive cricket match, especially during hot summer days. Hence, one should go for shoes that offer proper ventilation and circulation of air that helps in keeping the feet dry. (How to select the right cricket shoes for your game?, n.d.)

Spikes

In the case of the batters, half spikes can do the job because they offer more responsiveness and are lighter. On the other hand, bowlers use total points to provide better grip and stability, which is very important. (How to select the right cricket shoes for your game?, n.d.)

Benchmarking

Many big sportswear giants, such as Adidas, New Balance, Puma, and Nike, are Cricket specialized sportswear manufacturers of high-quality cricket shoes used by these professional players. (How to select right cricket shoes for your game?, n.d.)

Adidas 22yds Full Spike II Cricket Shoes, $108

This innovative shoe is constructed for a new generation of Cricketers. The rigors of modern-day batting have been revolutionized due to the explosive movements batters must perform in different formats of the match. Although irrespective of the form, the batsman must make quick, explosive movements to maneuver the ball around the field, and this shoe has been specifically designed for that purpose. A combination of comfortable, lightweight materials provides breathability, support, and extra grip. This shoe has adiPRENE – lined insole that dissipates rebound shockwaves to reduce stress on the joints and soft tissues. The compression-molded EVA midsole offers lightweight cushioning. Full-rubber Traxion outsoles are explicitly made for nets training or hard pitches. The Torsion system with climacool vents provides bridge midfoot support and forefoot flexibility. It is built on the runner's specific last to provide a superior fit. (2022 Adidas 22 YDS Full Spike II Cricket Shoes - Acid Yellow, n.d.)

Figure 18: Adidas 22 YDS full spike II cricket shoes (All Rounder Cricket, n.d.)

2022 Adidas Adipower Vector Cricket Shoes, $181

Regardless of the bowling style, the Adidas Adipower Vector Cricket Shoes are a combination of comfortable and protective materials for improved feel and safety. The transition through the crease is made more accessible due to the shoe's construction throughout the sole. Other features, such as the beveled heel, a new outsole reducing weight, and mid-sole cushioning, enable the player to feel comfortable and safe at the crease while maximizing performance. It also has a revolutionary new outsole, TPU materials which decrease the weight. The EVA midsole with adiprene in the heel adds extra cushioning. It also has a beveled heel for a better transition between the jumping and landing phases while delivering the ball. It also has a Velcro band of power midfoot strap to lock the foot in place for a better fit and comfort. (2022 Adidas Adipower Vector Cricket Shoes - Acid Yellow, n.d.)

Figure 19: 2022 Adidas adipower vector cricket shoe (All Rounder Cricket, n.d.)

2022 New Balance CK10 BL4 Cricket Shoes, $114

New Balance CK10 BL4 is the new version of the cricket boot that offers lightweight cushioning for that comfort on the pitch. The shoe also features selective melt on the upper that provides zonal support. Like the previous New Balance cricket shoes, this shoe also features a Revlite midsole for shock absorption and cushioning. It has an internal support system that provides additional stability. (New balance CK 10 bi4 Cricket Shoes - 2022, n.d.)

Figure 20: 2022 New Balance CK10 BL4 cricket shoe (All Rounder Cricket, n.d.)

2022 New Balance CK4040 R5 Cricket Shoes, $119

Working in tandem with some of the world's fastest bowlers, New Balance has designed this shoe that meets the rigorous demands of fast bowlers, enabling them to perform at their peak. This shoe is popular among elite fast bowlers as it provides the required protection, support, and cushioning under high impact.

Figure 21: 2022 New Balance CK4040 R5 cricket shoe (All Rounder Cricket, n.d.)

Payntr XPF-AR All-Rounder Spike, $119

The XPF-AR All-Rounder Spike is designed based on a running last to provide a superior snug fit and feel with elements that are used for increased stability and flexibility for all-around performance. It features a fully welded PU upper with foamed support around the forefoot that allows the player to engage in multi-directional movements during batting and fielding and a compression-molded EVA midsole that provides the needed stability while bowling. The show has an anti-slip resistant insole that grips the foot in place to maximize performance while reducing the impact and stress caused on the joints. It features a 7/4 spike formation outsole plate with 2mm high TPU lugs across the center of the outsole reducing force through the foot while landing, and 5mm lugs around the perimeter of the outsole to enhance the grip and traction in the delivery stride. (XPF-ar all-rounder Spike (adults), n.d.)

Figure 22: Payntr XPF-AR all-rounder spike (Payntr, n.d.)

Payntr XPF-P6 Bowling Spike, $129

The XPF-P6 is an ultimate bowling shoe designed specifically for fast bowlers. Like the XPF-AR All-Rounder spike, it is created on a running last to provide a superior fit and feel. It features a firm compression-molded EVA midsole and a fully welded PU upper with foamed support in the forefoot that offers extra stability and comfort. The shoe also has an oversized heel counter that locks the foot in position through every phase of bowling action to ensure the player performs at its peak performance. (XPF-P6 Bowling Spike, n.d.)

Figure 23: Payntr XPF-P6 bowling spike (Payntr, n.d.)

Product Anatomy

Spikes

Cricket shoes are also available without spikes, but most cricketers, whether bowlers or batters, prefer using shoes with points. The configuration and the number of points depend primarily on the manufacturer, as does whether the tips are removable. Most cricketers prefer removable spikes tips as they can be replaced when necessary and plastic studs can be added instead depending on the environmental conditions. (Cricket Shoes & Spikes, n.d.)

Spikes on the shoes help to provide grip on the ground. It offers immense grip, especially when the pitch is wet. (JammykCric, 2015)

Outsole

The outsole is the base of the cricket shoes and is generally made up of high abrasion resistance rubber with or without cricket spikes. Rubber offers excellent cushioning and grip both on natural and artificial pitches. Most medium and fast bowlers require a whole point with a sturdy upper, whereas the batters prefer lightweight, half-spike, or spike-less shoes. (Murray, 2022)

Midsole

The midsole is the layer between the outsole and the insole and is specially designed for shock absorption. The bowlers need good cushioning as they must quickly sprint before every delivery and run on the field when fielding. The batsman also needs softening so that their innings last long and they can be comfortable without impacting their game. (JammykCric, Khelmart.org | It's all about Sport, 2015)

Insole

The insole is the soft or hard cushioning material stitched to the upper. It offers additional comfort to the cricketers. Especially during ODIs or Test matches, most batters prefer soft insoles. On the other hand, fast bowlers usually use plastic, carbon fiber, or rigid insole materials to alleviate or eliminate pain or strain in the lower limbs. (Understanding the Anatomy of Cricket Shoes, 2022)

Heel Counter

The heel counter keeps the foot safe and secure. The heel counter should be comfortable as it needs to fasten the back of the foot. Bowlers need to secure the heel when their feet touch the ground. It stays secure. The batsman to needs a comfortable heel counter, so they do not feel

irritated while running between the creases. (JammykCric, Complete Guide on Cricket Shoes, 2015)

Heel Collar

The heel collar, or the heel cuff, is the topmost layer of a shoe that supports the heel and the Achilles Tendon. The primary purpose of the heel collar is to prevent the foot from slipping inside the shoe, which in return offers more stability while running. Many brands, such as Asics, Kookaburra, and Nike, use memory foam that shapes itself around the wearer's heel every time they wear the shoe. (Understanding the Anatomy of Cricket Shoes, 2022)

Upper

The upper is part of the shoe that covers the foot. Since the upper is in close contact with the foot, it must be flexible and comfortable. Most of the shoe's upper offer ventilation as the matches tend to last very long. Most cricket shoes are designed in a low-cut style, offering the ankle more flexibility. Mainly the bowler's shoes are designed in mid-cut or high-cut style. This way, the shoe provides excellent support to the ankle during delivery and follow-through stage and tries to prevent injury. (JammykCric, Complete Guide on Cricket Shoes, 2015)

Different manufacturers opt for other materials and technologies to ensure their shoe upper meets the core requirements; some additional extras, such as anti-scuff coating or additional fastenings for protection. (Cricket Shoes & Spikes, n.d.)

Figure 26: 2022 Adidas adipower vector cricket shoes (All Rounder Cricket, n.d.)

State-of-the-art Materials

Outsole

The outsole of any cricket shoe is typically made up of PU (Polyurethane), as it needs to be very robust to withstand constant impacts. They usually have a spike plate fitted to add metal spikes. Some shoes have rubber dimples or a cleat design for added grip instead of metal spikes. Pebax, known adequately as Polyether Block Amide (PEBA), is a high-performance thermoplastic elastomer commonly used in outsoles and damping system components. It also has a low density and is flexible. (Cricket Shoes: The Ultimate Guide from Morrant Sports, n.d.)

Midsole

Ethylene-Vinyl Acetate (EVA)/Phylon

EVA is the most common material used for cricket shoe midsoles as it is an extended foam/rubber with good shock absorption properties. It is also lightweight, waterproof, low cost, and offers UV protection. (Cricket Shoes: The Ultimate Guide from Morrant Sports, n.d.)

spEVA

This proprietary material by Asics has 'bounce back' characteristics and is designed to prevent midsole breakdown when running. Different densities, 45, 55, and 65, offer different stiffness levels and cushioning. (Cricket Shoes: The Ultimate Guide from Morrant Sports, n.d.)

Solyte

This material is also developed by Asics but is lighter than SpEVA and offers excellent cushioning, durability, and responsiveness. This material is also available in 3 different degrees of densities – 45, 55, and 65 and can be used to replace the board in board-lasting/combination lasting. (Cricket Shoes: The Ultimate Guide from Morrant Sports, n.d.)

Zoom Air

As the name suggests, Zoom Air is Nike's premium air shock absorption technology and is often used in midsoles of Nike cricket shoes. Apart from shock absorption, it helps in retaining shape and buoyancy. (Cricket Shoes: The Ultimate Guide from Morrant Sports, n.d.)

Upper

The most used materials for the upper of cricket shoes are PU/TPU, i.e., Polyurethane or Thermoplastic Polyurethane which is often combined with PVC-based synthetic leathers. PU is also used across other shoe parts, including the heel and torsion systems. (Cricket Shoes: The Ultimate Guide from Morrant Sports, n.d.)

Heel

The most common material used for heels is adiPrene/adiPrene+, developed by Adidas, a family of Polyurethanes that offers enhanced shock absorption and great bounce back and can be used in the forefoot. (Cricket Shoes: The Ultimate Guide from Morrant Sports, n.d.)

State-of-the-art Manufacturing

Lasting

Slip Lasting

In slip-lasting, the upper is stitched or glued directly to the midsole. (Cricket Shoes: The Ultimate Guide from Morrant Sports, n.d.)

Board Lasting

Inboard lasting, the upper is attached to the bottom of a flexible board which is then fixed atop the midsole. (Cricket Shoes: The Ultimate Guide from Morrant Sports, n.d.)

Partial/Combination Lasting

In this lasting, both slip-lasting method and board-lasting methods are used. Slip lasting makes a shoe lighter but provides less support than board staying. (Cricket Shoes: The Ultimate Guide from Morrant Sports, n.d.)

Upper

The upper material is mainly polyethylene or microfiber because it is lightweight and looks like leather. It is also used in combination with PU / TPU. All the upper pieces are sewn together. (Betwala, 2019)

Midsole/Outsole

The midsole of the shoe is generally compression-molded EVA or CMEVA. The compression-molded EVA midsole is bonded to a rubber outsole. Some companies also use Injection EVA midsole with rubber inserts. This type of midsole is thicker and has smoother skin than compression-molded EVA. It is also very light and flexible but wears off quickly. (The Shoe Dog, 2015)

Intellectual Property and Patent Study

Locking Cleat and Replaceable System

Current Assignee: Mac Neil Engineering Co Inc, Patent number: US5036606A

This patent is of a traction cleat, which is also one of the essential features of cricket shoes. This traction cleat has a cylindrical cuff disposed concentrically around the screw. The cylindrical cuff features one or more axially oriented splines disposed on its inner or outer surface. This traction cleat design claims to provide a support structure that extends radially outwards from the area between the engagement means and the head part along the vertical axis. (Locking cleat and receptacle system, n.d.)

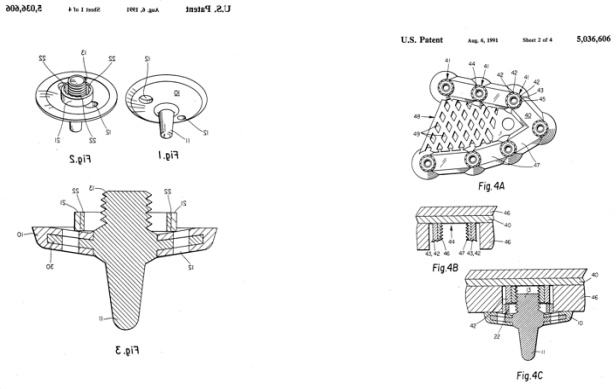


Figure 27: U.S. Patent US5036606A, Locking cleat and replaceable system (Google Patents, n.d.)

Removable Shoe Spike System

Current Assignee: Nu Tech Ventures Inc, Patent Number: US20150189950A1

This patent shoe of removable spikes showcases methods and apparatus adapted for quick and easy exchange of spikes on athletic shoes. The system comprises a spike with an opening adapted for coupling to the shoe. The disclosure, in return, allows the user to have the tool

permanently attached to their shoe to avoid carrying additional equipment while wearing these shoes. (Removable Shoe Spike System, n.d.)

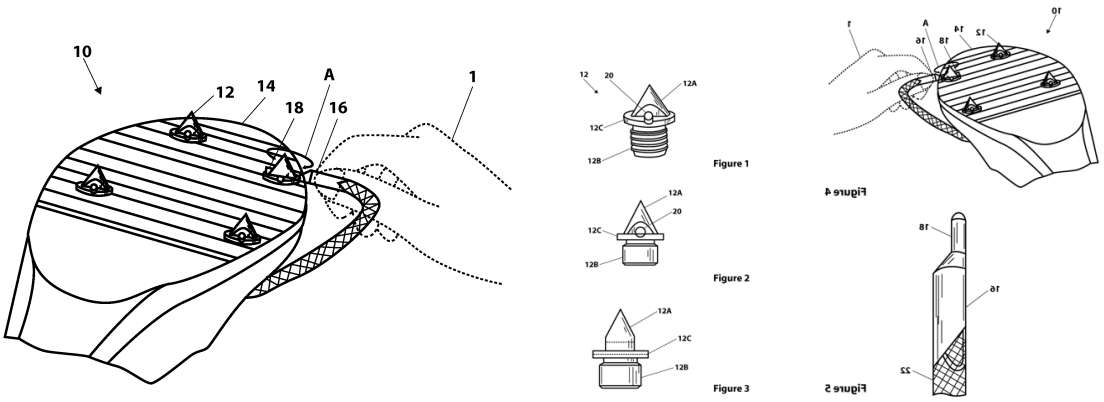


Figure 28: U.S. Patent US20150189950A1, Removable shoe spike system (Google Patents, n.d.)

Shoe Spike Assembly having Cushioning Device.

Inventor: Canon Liao, Patent Number: US6442872B1. This shoe patent consists of an invention related to spikes, specifically the spike assembly for shoes and having a cushioning device for absorbing the shocks and vibrations transmitted to the foot on the impact on the ground. The spike system includes an upper fastener that secures the shoe sole and a lower stem to which the cap is attached. A cushioning pad is placed between the cap and the spike, and another is placed between the cap and stem to provide the necessary cushioning and shock absorption. (US6442872B1 - shoe Spike Assembly having cushioning device, n.d.)

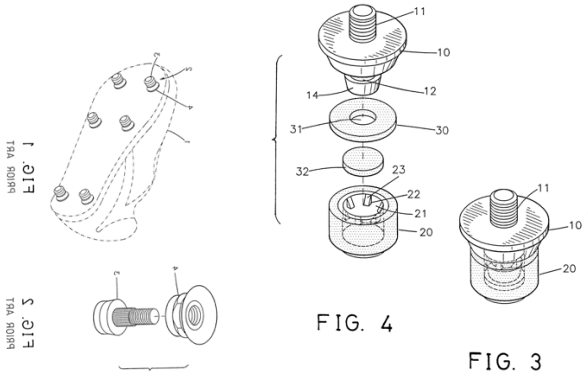


Figure 29: U.S. Patent US6442872B1, Shoe spike assembly having cushioning device (Google Patents, n.d.)

State-of-the-art Color Trends

There are no restrictions on the color of shoes that cricket players use. However, during test matches and ODIs, 70% of the footwear must be white inclusive of tongue and laces, and the remaining 30% can be any color. Most of the time, manufacturers use the 30% color same as the playing kit. (Clothing and Equipment Rules and Regulations, n.d.)

Currently, the cricket shoes manufactured by sportswear brands such as Adidas, New Balance, Puma, Nike, and Payntr make shoes with base colors and accent colors matching the national team playing kit. However, all players choose cricket shoes that are more comfortable and cater to enhancing their performance irrespective of brand or color.

Figure 30: *2022 New Balance CK10 BL4 cricket shoe, Adidas 22 YDS full spike II cricket shoe, Payntr XPF-AR all-rounder spike* (All Rounder Cricket, n.d.)

Future Color Trends

The future color trends in this sport need to move out of the space where it just resonated with the team playing kit. The color palette of the national team or country leagues mostly stays the same except for some changes in detailing and prints. The players are free to wear any color and brand of cricket shoes for T-20 matches, irrespective of their team color. This allows

freedom to design cricket shoes featuring bring and bold accent colors to develop positive feelings and help maintain high energy as the matches tend to last for at least 3-4 hours.

Based on the 2023 WGSN trend forecast, two potential color trends can feature bold, bright, and vibrant colors.

High Contrast Brights

This color palette features bright, bold, warm, and cool colors. Using a combination of complementary warm and cool shades as the accent colors for cricket shoes will create a positive mindset among the players. This palette is also exuberant, uplifts the mood, and helps facilitate self-expression and joy. Since this palette combines multiple intense colors, it will work best with lively prints, ombre effects, and layered colors inspired by digital design. According to the WGSN forecast, this palette would be great for endurance sports, snow sports, and lifestyle category designs. (Kostiak, Active Colour Forecast A/W 24/25, 2022)

Figure 31: High contrast brights (Kostiak, 2022)

Bold Blues and Green

As the name suggests, this color palette consists of bright and bold tones of green and blue as a solid color contrasting with high-contrast accents of orange, white, and black. According to WGSN, this palette can be used in snow-sport styles, endurance products, high-impact sneakers, and lifestyle pieces. (Kostiak, 2022)

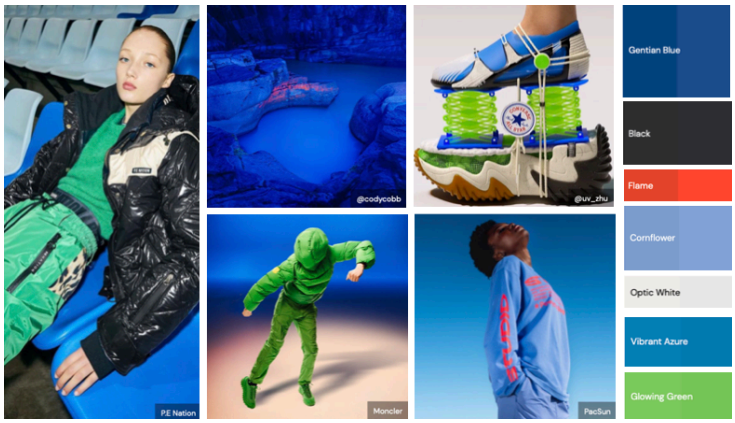


Figure 32: Bold blues and green (Kostiak, 2022)

These future trends provide a good balance between base neutral colors and strong bright accent colors. Out of these trends, the High Contrast brights and Bold Blues and Green would be a more suitable palette for this project as it offers a good balance of optic white as the base color with different shades of blue to choose from for accent. Orange can be used to highlight certain sections of the upper as well as on outsole spike detailing to add more visual depth. Blue is a soothing color that symbolizes mild positivity, stability, and tranquility, making it a better choice for the accent color palette of the shoe.

State-of-the-art Graphic Trends

There needs to be more design detailing on the current cricket shoe design in terms of graphics, creating room for a new design opportunity in this space. This will also allow contemporary design aesthetics, which might evoke positive emotions among the players.

Figure 33: Nike Lunar Dominate, New Balance CK10 BL4 cricket shoe, Nike Lunar Accelerate 2 (Williams, 2013) (All Rounder Cricket, n.d.) (sports jam, n.d.)

Future Graphic Trends

Most sports performance footwear does not feature bold and abstract patterns; instead, they have very subtle, simple, and minimal geometric forms that add value to the design aesthetics. Performance is always a top priority for any sports shoes. However, aesthetics such as color, material, and finish also play an important role from a consumer's point of view. Hence based on WGSN trends, future graphic directions can be chosen for performance footwear.

Energized Knits

This graphic and material palette comprises knits of bold and energized colors paired with contrasting bright as well as stitches and textures. This combination helps to create lively and cheerful emotive appeal. This trend mainly features prints, stripes, and ombres made using embroidery, jacquard, spacer knits, and multicolored yarns. It also focused on creating depth of field and 3D textural interest through different knitting techniques and technically enhanced products. This trend by WGSN is mainly used in endurance sports, snow sports, and lifestyle.

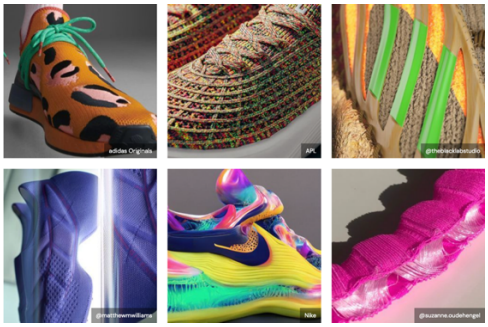


Figure 34: Energised knits (Browning, 2022)

Tactile Minimalism

This graphic and texture trend by WGSN features minimalist finishes with soft lines and tactility. This visual/texture trend adds lightness to the sneaker despite using hard and soft materials by creating an effect of layering, embossed surface, and 3D structure. This trend experiments with 3D geometry and structure with simple lines and shapes. In terms of

sustainability, it also focuses on circular design and monomateriality, which could be easy to deconstruct at the end of the product's life. (Browning, 2022)

Especially for a cricket shoe where stability is one of the key features, this tactile texture can be a new design direction that could help improve performance. This texture could be paired with soft materials to add the structural support needed in a fast bowler's shoe. This texture could also be effective for the outsole tread pattern in proving good traction on the field with and without spikes.

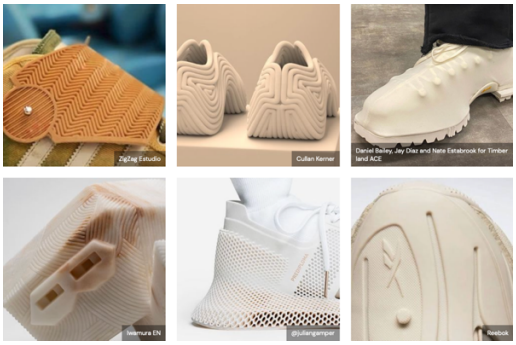


Figure 35: Tactile minimalism (Browning, 2022)

Milky Sheers

This graphic/texture palette by WGSN focuses on creating calming effect by using a textured translucence trend and creates gentle tints by muting bright pop layers beneath them. It incorporates smooth and semi-opaque surfaces. This can also explore technological advances in TPR, TPU, and TPE outsole materials. The upper can use layers mixing muted, bright colors for unique textural interests and on the tongue, trims, and outsoles. (Brownings, 2022)

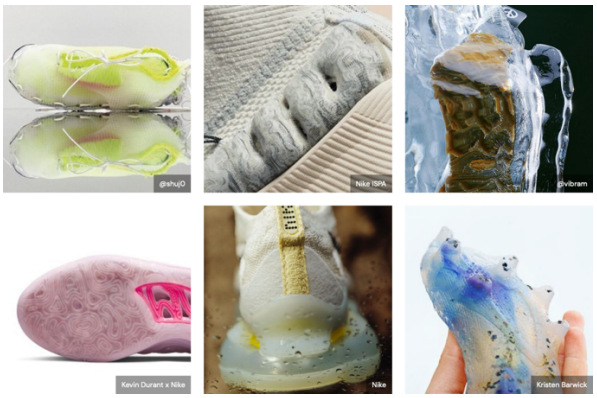


Figure 36: Milky sheers (Browning, 2022)

Tactile minimalism and Energised knits are all about embossed textures on the upper and the midsole design. The current Cricket shoe designs feature leather, mesh panel uppers, and a standard EVA midsole with grooves. Having 3d textures on the upper that are not just visual elements but also offer great functionality to some regions of the upper and support the foot inside the shoe, such as the heel counter reinforcement to keep the heel stable in the shoe and hard-shell toe cap to protect the forefoot from the ball impact. Milky sheers are all about the textured translucence trend that uses semi-opaque surfaces with a ting of color to add depth. The application of this trend can be used on the outsole design along with spikes, as the current shoe designs feature an opaque rubber textured outsole. Using this trend on the outsole design can give a new perspective to Cricket footwear designs.

State-of-the-art Branding and Logo

The manufacturers of current cricket footwear are sportswear giants such as Adidas, New Balance, Puma, and Nike, and some local brands such as Payntr and Kookaburra use their unique styles to showcase their branding. They have been using heat melts (Bemis), synthetic leather cutouts sewn on the upper, printing the brand name on the lateral/medial side of the midsole, as well as a part of the outsole tooling design.

Figure 37: Adidas 22 YDS full spike II cricket shoe, New Balance CK10 BL4 cricket shoe, Nike Lunar Accelerate 2 cricket shoe (All Rounder Cricket, n.d.) (Amazon, n.d.)

Future Branding and Logo

Gradients are one of the new trends in logo and branding that helps elevate the design by creating a 3D effect using shadows and highlights and making it pop. Another prevalent logo trend is 3D logos, which provide a fresh take on branding, and many upcoming startup companies are using such logo designs. The new trends in logo and branding also suggest that the logo must be simple, colorful, and meaningful that connect well with the target consumers. Cricket is a classic, competitive, high-performance sport with a rich history. It was also considered a royal white-collar sport at one point in history. Hence, using rugged, timeless typography for the branding would be an ideal choice.

The common places for branding and logos on a Cricket shoe are the heel counter, tongue, lateral/medial midfoot area, and outsole. The current designs use heat melts on the upper for branding. In terms of the future of branding, the logos can be a part of 3d textured upper paneling and using parts of the shoe like the laces and pull-tab having brand name and logo.

Physiological Research

Studies suggest that the physiological requirements for cricket players are mild and not very intense like some other outdoor team sports, except for fast bowlers who bowl in prolonged warm conditions. To develop stamina among cricket players, they are highly advised to run, skip, or cycle for 10-20 minutes in a session. The players were also encouraged to do power training exercises such as push-ups, sit-ups, and 'swing the cricket bat' exercises to build strength. Apart from stamina and strength development, cricket players must be highly mobile. They were advised to perform wide stride sitting, toe touching, and head and shoulder circling to improve their mobility. (Noakes & Durandt, 2001)

The study also suggests that any activity above the exercise intensity must be undertaken in the presence of inadequate oxygen and blood supply to activate the skeletal muscles. The active muscles must contract 'anaerobically.' During a comparatively hot day, the fast bowlers achieved a relatively high sweat rate of 1.5 l/h, compared to 1 l/h during warm and cool days. Also, the mean heart rate during a day's cricket match seldom rose above 128 beats/min in batters and fielders, whereas the heart rates of fast bowlers can reach anywhere between 180-190 beats/min for a relatively shorter period. Lastly, the blood lactate concentration seldom exceeds 5mmol/l in fast bowlers compared to high-intensity exercises; for one hour, lactate concentration was as high as 10mmol/l. (Noakes & Durandt, Physiological requirements of cricket, 2001)

The cricketers are protected from the risk of developing hypoglycemia by scheduling breaks for tea and lunch after every 2 hours during the matches. They are also not exposed to the risk of playing at high altitudes because of the absence of sufficiently large flat playing surfaces. (Noakes & Durandt, Physiological requirements of cricket, 2001)

Biomechanical Research

There are 5 ‘S’ used for batters: Step, Stabilize, Shoulders, Swing, and Straight. The batsman must follow the main five batting biomechanical stances to be on top of their game. It starts with setting their body in a steady position with no further movement. Force alignment is essential for the batsman. They begin by rotating the shoulders slightly forward by the top of the backswing. The width of the back encompasses the arms and shoulders. For the batsman, the hit's accuracy is the bat swing's alignment and the ball’s flight path. This principle applies to both the cross-bat strokes as well as the vertical strokes.

Figure 38: Biomechanical analysis of a batter (Hurrion, 2013)

For the bowlers, the speed of the ball is the crucial determining factor for their successful delivery. The research was conducted at Loughborough to determine the speed of the ball with the fast run-up, braced front knee at ball release, delayed swinging of the bowling arm, and greater trunk flexion between front foot contact and ball release. The research outcome demonstrated the link between the speed of the ball and horizontal impulse, reduced vertical ground reaction forces, and slower vertical and horizontal loading rates. The result of this study also depicted that the male fast bowlers utilized a technique that generated linear momentum in the run-up, which was conserved through the delivery stride.

The study also showed that cricket plays a unique physiological demand in the musculoskeletal system. Especially the fast bowlers are subjected to large ground reaction forces and muscular forces around the lumbar spine.

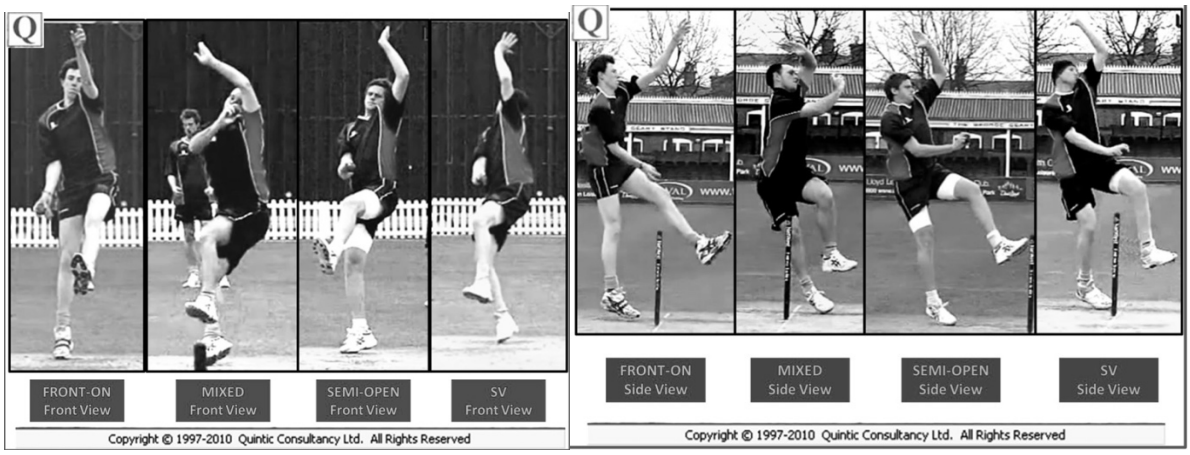


Figure 39: Biomechanical analysis of four types of bowling (Hurrion, 2013)

Psychological Research

Mental health in elite sports players has always been a topic of discussion. Few studies were conducted to address the cause and effect of mental health disorders among elite-level cricketers, which included players who competed at national, international, or professional levels. Especially elite cricket players have always been a prominent subject in the mainstream media regarding mental health. Five studies covered a range of mental health-related symptoms and disorders, including distress, anxiety, depression, sleep disturbance, suicide, adverse use of alcohol, illicit drug use, eating disorders, and bipolar disorder. (McCabe, Pierce, Gorczynski, & Heron, 2021)

These studies showed that cricketers were at high risk for distress, anxiety, and depression. Also, rates of suicide were high for test cricketers. Due to the lack of definitive data on mental health among cricketers, this topic should not be ignored by the wider cricket multidisciplinary team. (McCabe, Peirce, Gorczynski, & Heron, 2021)

Cricket is widely played across a variety of counties and cultures across the globe. Due to this, the understanding, stigma, and resources to support and encourage mental healthcare provision vary significantly. The International Cricket Council (ICC) must ensure minimum standards of care for mental health among these elite cricket players. (McCabe T. , Peirce, Gorczynski, & Heron, 2021)

Head injuries in cricket, including sport-related concussion, is linked with mental health and is a significant area of focus within this sport area. Helmets are used widely by batters, wicketkeepers, and some umpires. Even though using them has not been proven effective in reducing the rates of concussions in the sport. Touring is also an essential part of this game, especially when the matches are played on an international level. This results in staying away from home for a more extended period and consequent dislocation from the individual's standard support mechanism. Also, most of these matches played in Test Cricket format, or ODIs is, played over five days span, which causes a huge mental toll on these athletes and adds pressure to perform. Better every single day of these series.

Players may develop pathological defense mechanisms when facing stress outside traditional social supports and environments. (McCabe T. , Peirce, Gorczynski, & Heron, Narrative review of mental illness in cricket with recommendations for mental health support, 2021)

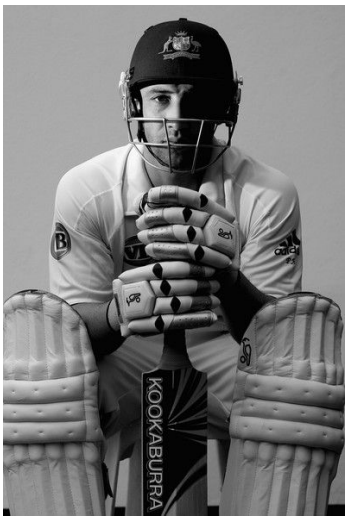


Figure 40: Phil Hughes, Australian cricketer (Blair, 2009)

Consumer Research Methods

The data collection for this project will be conducted in three stages:

Questionnaire and Survey

The first step would be to conduct a detailed digital survey that focuses on the current state and problems faced by the two-player positions, fast bowler, and the batter, using online tools such as google forms or survey money. This survey will collect insights from 10-12 professional bowlers and batters. Once the data is collected, the next step would be to analyze the key insights and make sure it aligns with the golden statement created at the beginning of this project and, if not, how that can be incorporated into it.

Interviews

The next step would be creating a separate survey/short interview with cricket trainers and coaches to understand the problem and get insights and feedback from their points of view.

Market and Retail Research

I will look at online product reviews of these state-of-the-art products in the market and by professional cricket players and coaches to understand the need and missing links in the product space.

Athlete Survey Questionnaire

Survey Introduction: For Bowlers

Performance Cricket Footwear for Bowlers

Hello! This questionnaire is authored by Aarya Ghule. I am pursuing a master's degree in Sports Product Design from the University of Oregon, Portland. Currently, I am working on my final year thesis project on designing Performance footwear for Cricketers playing at two player positions: Bowler and Batter.

To help me explore possible design solutions, I would like to ask you about your specific experience and challenges that you face with your current footwear as well as suggestions on the improvements in the current designs. Your feedback is extremely valuable to me and I would be extremely grateful if you could spend a few minutes filling out this survey. This questionnaire is specifically aimed at bowlers.

Survey Introduction: For Batters

Performance Cricket Footwear for Batters

Hello! This questionnaire is authored by Aarya Ghule. I am pursuing a master's degree in Sports Product Design from the University of Oregon, Portland. Currently, I am working on my final year thesis project on designing Performance footwear for Cricketers playing at two player positions: Bowler and Batter.

To help me explore possible design solutions, I would like to ask you about your specific experience and challenges that you face with your current footwear as well as suggestions on the improvements in the current designs. Your feedback is extremely valuable to me and I would be extremely grateful if you could spend a few minutes filling out this survey. This questionnaire is specifically aimed at batters.

Survey Questions Specific to Bowlers

1) How long have you been playing professionally?
2) Do you play Test cricket or T20 format cricket matches?
3) Are you a left-handed or a right-handed bowler?
4) Are you a spin bowler or a fast bowler?
5) Which style of bowling delivery do you prefer the most?
6) What type and brand of footwear are you currently using for your matches?
7) What problems do you face with your current footwear?
8) What are the specific features you like or dislike about the current footwear?
9) Are you prone to any specific types of injuries while playing? If so, how often do they occur?
10) Does the weather change affect your playing performance? If so, how?
11) Does the weather change affect your footwork while playing?
12) Do your feet sweat a lot while playing in hot climate conditions?
13) Does the weather cause any other foot problems while playing?
14) If there were no restrictions, what would an ideal bowler-specific cricket shoe look like to you?

Survey Questions Specific to Batters:

1) How long have you been playing professionally?
2) Do you play Test cricket or T20 format cricket matches?
3) Are you a left-handed or right-handed batter?
4) Are you a top-order batter, middle-order batter, or tailender?
5) What is the perfect batting stance for you?

6) What type and brand of footwear are you currently using for your matches?
7) What problems do you face with your current footwear?
8) What are the specific features you like or dislike about the current footwear?
9) Are you prone to any specific types of injuries while playing? If so, how often are you inclined to do it?
10) Does the weather change affect your playing performance? If so, how?
11) Does the weather change affect your footwork while playing?
12) Do your feet sweat a lot while playing in hot climate conditions?
13) Does the weather cause any other foot problems while playing?
14) What does an ideal cricket shoe specifically for batters looks like to you?

Athletes Contacted

Two surveys focused on two user groups, bowlers, and batters, were created, and shared with the athletes. Multiple athletes from different nationalities playing for various professional cricket clubs were contacted. All these athletes were contacted via social media platforms such as Instagram and LinkedIn.

Team USA

Syed Abdullah (Top-order batsman)

Fahad Babar (Opening batsman)

Adil Bhatti (All-rounder, right-arm medium-fast bowler capable of batting anywhere in the top 6)

Akeem Dodson (Top-order batsman, Wicketkeeper)

Nosthush Kenjige (left-arm orthodox spinner)

Akeal Hosein (left-arm orthodox bowler)

Ali khan (Fast bowler)

Jaskaran Malhotra (Top-order batsman)

Xavier Marshall (Top-order batsman)

Prashant Nair (Spin-bowler)

Saurabh Netravalkar (Left-arm fast bowler)

Japen Patel (All-rounder)

Nisarg Patel (left-arm orthodox batsman, all-rounder)

Sagar Patel (Opening batsman)

Jessy Singh (Right-arm medium fast bowler)

Steven Taylor (Top-order batsman, off-spin bowler)

Team Canada

Shreyas Movva (Wicketkeeper, batsman)

Aaron Johnson (All-rounder)

Saad Bin Zafar (All-rounder)

Trevin Bastiampillai (Right-handed batsman)

Nikhil Dutta (All-rounder)

Rommel Shahzad (Right-handed off break bowling)

Kaleem Sana (Fast bowler)

Nicholas Kirton (Left-handed batsman)

Jeremy Gordon (Right-arm fast bowler)

Team Australia (Queensland Cricket Club)

Daniel Hughes (Left-handed batsman)

Max Bryant (Right-handed batsman)

Sam Truloff (Right-handed batsman)

Conner Sully (Right-handed batsman)

Jack Edwards (All-rounder, right0handed batsman, right-arm medium bowler)

Jonathan Merlo (All-rounder, right-handed batsman)

Xavier Bartlett (Right-arm fast bowler)

James Bazley (All-rounder, Right-handed bowler, and batter)

Jack Clayton (Left-handed batsman)

Blake Edwards (right-arm pace bowler)

Sam Heazlett (left-handed batsman)

Matt Kuhnemann (left-arm spinner)

Marnus Labuschagne (All-rounder, right-handed batsman)

Will Prestwidge (Right arm bowler)

Bryce Street (Left-handed batsman)

Team India

Naushad Shaikh (Right-handed batsman)

Kaushal Tambe (Right-arm off break bowling, righ- handed batsman)

Pavan Shah (Right-handed batsman)

Tanush Kotian (Right-arm off break bowler)

Ashay Palkar (Right-handed batsman)

Siddhesh Veer (Left-handed middle-order batsman)

Avdhoot Dandekar (Right-handed batsman)

Yash Nahar (Right-handed batsman)

Satyajeet Bachhav (Slow left-arm orthodox bowler)

Athlete Survey Results: Bowler

How long have you been playing professionally?

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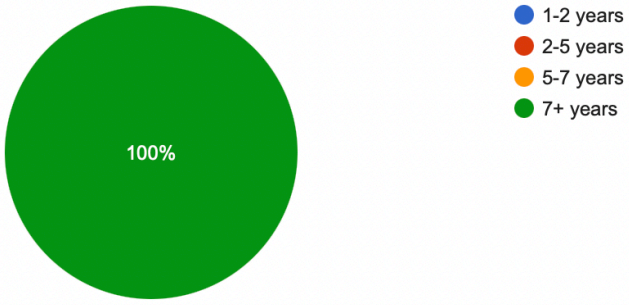
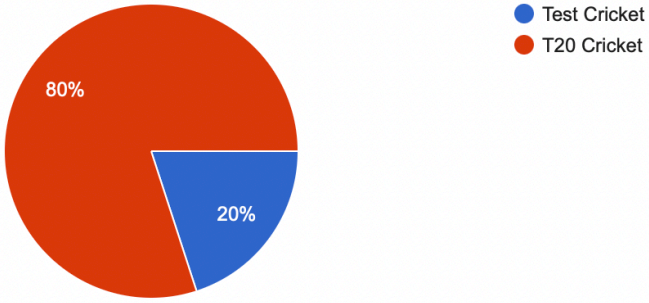
5 responses



Do you play Test Cricket or T20 format Cricket?

Copy

5 responses



Are you a left-handed bowler, a right-handed bowler, or an all-rounder?

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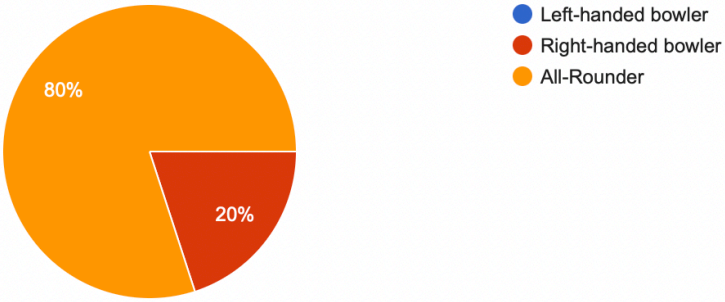


Are you a spin bowler or a fast bowler?

5 responses

- Fast bowler
- Fast bowler l
- Spin
- Spin bowler
- Fast bowler

Which style of bowling delivery do you prefer the most?

5 responses

- Fast / spin
- Fast
- Left arm spin
- Orthodox spin
- Fast

What type and brand of footwear are you currently using for your matches?

5 responses

- NB/ Puma / Nike
- Adidas
- Half spikes / New Balance RevLite
- Adidas rubber spikes
- Asics (Gel Speed Menace)

What problems do you face with your current footwear?

5 responses

None really

My big toe on the consistently rubs against the front of my left boot.

Shoe fitting is a little loose

Longetivity

It should last till 2 Seasons. Only In one season it gets tore off.

What are some specific features that you like and dislike about the current footwear and/or the general footwear styles available in the market at present?

5 responses

I am always looking for more variety and creative / cool designs

I really like the insole (is very soft, my shoes is very lite, I have really good ankle support and they are super comfy) the only issue would be my toe rubbing against the front of the shoe.

Likes - light weight/ breathable mesh material broad sole , dislikes- for my shoe size US 9
Is too tight and US 9.5 is a bit loose to my liking- so
So i have to compromise on fitting

Weight and design

Like : Great comfort/ Light weight/

Dislike : Gets damage sooner

Are you prone to any specific types of injuries while playing? If so, could you elaborate more?

5 responses

I have not had any.

Ankle, black and knee (so it's extremely import to have Comfy shoes, I with good ankle support and very good cushion whiles landing during bowling/ running)

Toes have to be well protected, if the ball hits you directly on the toe it can cause damage so it has to be sturdy material at the front

So far, none. But I do tend to have ankle issues

No

Does the weather change affect your playing performance? If so, how?

5 responses

No

Weather does affect performance but I can used to a particular weather.

Yes, I live in Canada so sometimes we play in single digits temperatures which is a challenge in it self to keep warm and also to performance at a high intensity.

And on the other hand it's played in really hot / humid weather which can also be very challenging.

Not too much as the shoes have metal spikes to give us a strong grip and hold

Does the weather change affect your footwork while playing?

5 responses

- Not really as long they are strong and comfortable shoes
- Yes. If it's wet / muddy it's harder run without falling/ slipping, so balance and efficiency is an issue during rainy days especially.
- Not much unless its raining heavily
- No
- No

Do your feet sweat a lot while playing in hot climate conditions?

5 responses

- No
- Yes. It does
- Yes they do- hence a breathable material is important
- Yes
- Not that much

Does the weather cause any other foot problems while playing?

5 responses

- No
- Just wear and tear over time
- None that I can think of

If there were no restrictions, what would an ideal bowler-specific cricket shoe look like to you?

5 responses

Really personal and cool design with creative colors

Maybe comfy basketball shoes / sneakers with spikes.

I prefer it to me light weight as we have to wear it for long hours and have to sprint in it. So need something that doesnt make ur legs feel heavy

One that's light weight and lasts for a long time. Once I am used to a specific shoe, I prefer not to change it often. Its similar to a bat for a batsman. Once you are used to it, that's your go to tool in a cricket field.

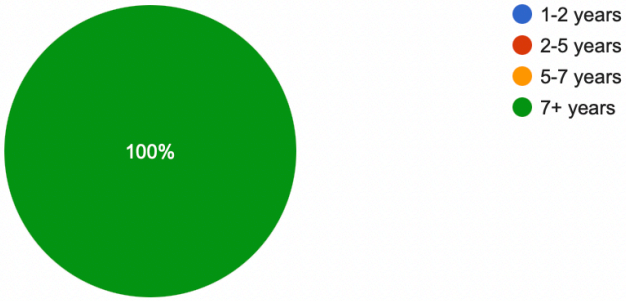
More light weight and extra spikes protection.

Athlete Survey Results: Batsman

How long have you been playing professionally?

Copy

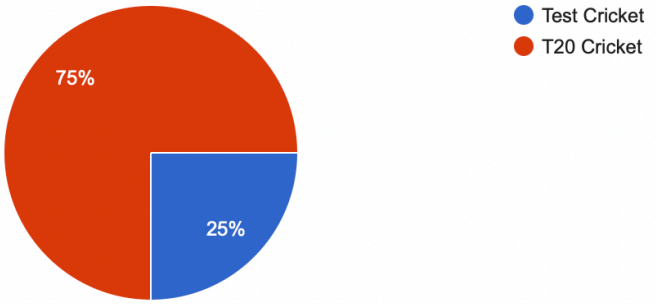
4 responses



Do you play Test Cricket or T20 format cricket?

Copy

4 responses



Are you a left-handed batsman, a right-handed batsman or an all-rounder?

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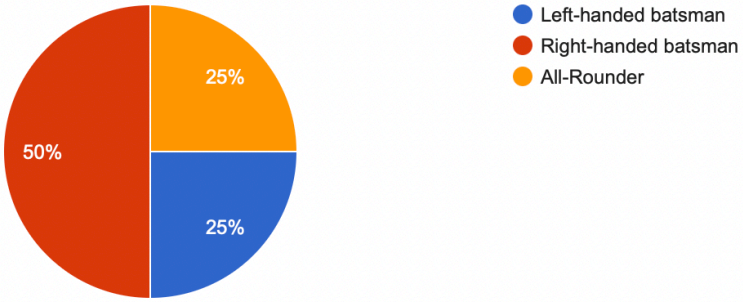
4 responses



Are you a top-order batsman, a middle-order batsman or a tailender?

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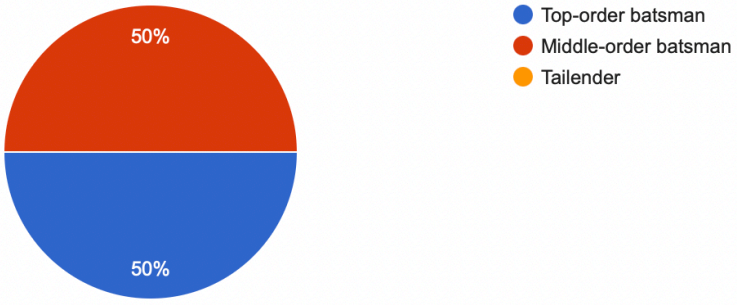
4 responses



What is the perfect batting stance for you?

4 responses

- Feet shoulder width apart, front foot rotated slightly forward, weight on the balls of feet.
- Little wide legs and distance between legs r equal to shoulders
- Left foot leaning towards the bowler
- Stance which is balanced, and allows you to be ready for any type of ball.

What type and brand of footwear are you currently using for your matches?

4 responses

- New Balance CK10V5
- Addidas full spikes
- Adidas
- Asics speed menace

What problems do you face with your current footwear?

4 responses

- They’re very good for batting, not as much support for standing in the field or bowling, but they have other options for that. Main problem are that once worn for a short period you can start feeling the spike formation under foot as you walk, instead of an even, flat spread of force throughout the sole, which is uncomfortable. Also the bottom of the shoe on the medial border of the foot, near the big toe starts to peel off as the back foot drags when batting.
- Nothing as of now but sometimes i feel little heavy..and comfrot wise also not upto d mark always
- I get shinand my shoes wrip from the toe area often
- No problem

What are some specific features that you like and dislike about the current footwear and/or the general footwear styles available in the market at present?

4 responses

Lightweight batting shoes are nice, space for toes to spread out as well and the ability to tie it up tightly. A normal tongue and a tab on the heel to help put the shoe on.

Dislikes - mostly comfortwise heavy and changing in shape after use

Nothing major but shoes wrip from my toe

Very less options for broad feet/flat feet

Are you prone to any specific types of injuries while playing? If so could you elaborate more?

4 responses

Soft tissue injuries (quads and hamstrings), sometimes big toe pain as I have a bipartite sesamoid bone. Sometimes PFJ pain in knees.

Not really but i used to have shin issues before

Shin splits

Ankle injury due to flat feet

Does the weather change affect your playing performance? If so, how?

4 responses

No, we stop playing if it's wet

Not really

Not necessarily

No

Does the weather change affect your footwork while playing?

4 responses

- Only if the pitch is more muddy and it's harder to change direction.
- Yes when outfield get soggy in rains..
U feel heavy while running
- No but when it's rainy then the bottom of the shoes gets all the mud stuck which makes it slippery sometimes
- No

Do your feet sweat a lot while playing in hot climate conditions?

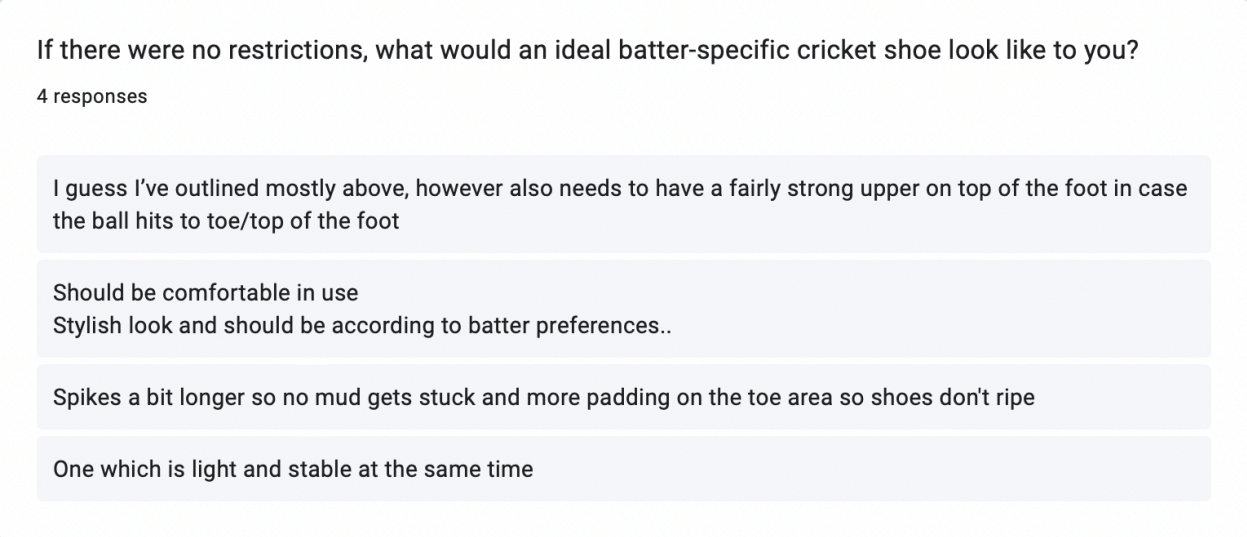
4 responses

- Not much if I'm wearing good socks, unless it's very hot.
- Yes
- Yes
- No

Does the weather cause any other foot problems while playing?

4 responses

- No
- No no
- No



SWOT Analysis

SWOT analysis of 6 benchmarking footwear, 3 for bowler-specific shoes, and three batter-specific shoes are created, which are the benchmark products for this project. The SWOT is conducted in 4 different sections of the shoe, the upper, insole, midsole, outsole & spikes for each shoe. Based on the thorough SWOT analysis, many new opportunities for the insole, upper, and midsole have been identified. The textured insole could be a new design direction for this project and create better ankle support to stabilize the foot inside the shoe. Another design opportunity discovered based on the SWOT results is a better tread design on the outsole that offers good traction.

Adidas

Adipower Vector Mid Bowling
(Bowling)
$181

	Strengths	Weaknesses	Opportunities	Threats
UPPER	• Soft light & comfortable upper for improved comfort and reduced weight • Softer toe area • Velcro strap for locked foot • High cut heel collar	• Less toe protection as compared to the similar version of batting shoes	• Better ankle protection • Hard toe cap for protection And comfort • More breathable/sweat-wicking upper	• Upper focused towards comfort and less on providing stability
INSOLE	• adi-PRENE lines insole dissipates rebound shock waves to reduce stress on joints and soft tissues	• Less comfortable	• Textures insole to prevent pronation • Arch support • Material innovation • Removable insole	• Both player positions might have different needs and preferences
MIDSOLE	• Chunky sole for shock Absorption • Beveled heel for better transition between the jumping and landing phase during bowling	• No lateral support	• Arch support • Incorporating shank to support the arch	• Too much cushioning might affect the speed of fast bowlers
OUTSOLE & SPIKES	• TPU material instead of rubber to keep it lightweight • 7-3 spike combination	• Consistant tread pattern • Height of the tread pattern is too short. It might affect traction	• Zoning of tread for effective grip	• The current spikes might wear-off easily

New Balance

Adidas 22 YDS Full Spike II
(Batting)
$108

	Strengths	Weaknesses	Opportunities	Threats
UPPER	• Lightweight upper paneling • Breathable mesh • Strong toe protection • Long and wider tongue	• Less protection on vamp	• More support on the ankle area • Lateral support	• Shoes with only knit upper Would be breathable but might not offer good foot lockdown especially for fast bowlers
INSOLE	• adi-PRENE lines insole dissipates rebound shock waves to reduce stress on joints and soft tissues	• Less comfortable	• Textures insole to prevent pronation • Arch support • Material innovation • Removable insole	• Both player positions might have different needs and preferences
MIDSOLE	• Compression molded EVA • Lightweight cushioning	• No arch support • The cushioning does not offer that great bounce	• Alternative foam material • Equal focus on cushioning and arch support • Shank on fast bowler's shoes to offer that arch support	• Alternative foam material • Equal focus on cushioning and arch support • Shank on fast bowler's shoes to offer that arch support
OUTSOLE & SPIKES	• Full rubber Traxion • 7-2 spike combination • Outsole plate designed such that it also incorporates Replaceable rubber spikes • Default rubber studs on the outsole	• No lateral support for batters	• Zoned default rubber stud pattern • Different geometries of rubber studs can be explored	• Overuse of these rubber studs might wear off over time

New Balance CK4040
(Bowling)
$119

	Strengths	Weaknesses	Opportunities	Threats
UPPER	• Synthetic leather upper with perforations • High-density foam tongue for a snug and secure fit • Nylon webbing ankle strap that locks foot inside	• Adjustable ankle strap • Heel lockdown • Mid-cut for ankle protection	• Heel protection and heel lockdown • Forefoot lockdown for lateral movement	• The weight of the shoe might increase
INSOLE	• Regular running shoe insole design	• No grip while sprinting especially for fast bowlers	• Removable and washable • Textured insole with proper zoning	• Too much texture might rub along the Lower foot
MIDSOLE	• Fuel cell foam midsole • Thicker midsole compared to other models • Provides better rebound and energy return	• No arch support	• Better arch and lateral support	• Highly soft and cushioned midsole might affect the speed
OUTSOLE & SPIKES	• 3-4 spike alignment at fore-foot • 4 spike alignment at heel	• Current tread pattern has larger surface area and short height • No lateral support	• Zoned tread pattern	• This may sacrifice the speed

New Balance CK10 BL4
(All-rounder)
$114

	Strengths	Weaknesses	Opportunities	Threats
UPPER	• Synthetic leather upper for support • Breathable upper • Longer tongue, built-in and not stand alone	• Less toe protection	• Better toe protection • Forefoot lockdown for lateral movement	• Increase in weight
INSOLE	• Basic insole design	• No customization of insole	• Removable and washable • Grip texture to prevent the Foot from slipping/pronation	• High beveled grip might affect the speed of fast bowlers
MIDSOLE	• REVlite technology used in midsole for better performance • Low-density midsole compound for support as well as cushioning	• No lateral support	• Arch support • Less focus on cushioning, more focus on stability and sturdiness	• More cushioning might not be effective while running across the pitch
OUTSOLE & SPIKES	• 3-4 spike layout at the forefoot and 4 spikes at the heel	• Tread pattern is not very effective	• Better tread zoning for good traction • Weather resistant	• This may sacrifice the speed

Payntr

Payntr XPF-P6
(Bowling)
$129

	Strengths	Weaknesses	Opportunities	Threats
UPPER	• Lightweight upper • Slightly higher ankle cut • Adjustable ankle strap • Extended heel cup • One-piece upper • Extra hole for laces	• Less breathable	• Elastic ankle strap for adjusting the fit & tightness	• The current shoe might not have sweat wicking or breathable properties
INSOLE	• Regular running shoe insole design • Foam board underneath the insole	• No grip while sprinting especially for fast bowlers	• Removable and washable • Textured insole with proper zoning	• Too much texture might rub along the Lower foot
MIDSOLE	• High density midsole	• Lateral support on forefoot	• Providing stability without Sacrificing cushioning	• The current midsole does not offer better rebound
OUTSOLE & SPIKES	• 7-4 spike alignment • Extended outsole protection on the toe	• The current tread pattern might offer good grip but is not very wear-resistant	• Zoned tread pattern	• This may sacrifice the speed

Payntr XPF-AR
(All Rounder)
$119

	Strengths	Weaknesses	Opportunities	Threats
UPPER	• One-piece leather upper • Low ankle cut • Fully welded PU upper with foamed support around the forefoot	• Adjustable ankle strap • Heel lockdown • Mid-cut for ankle protection	• Heel protection and heel lockdown • Forefoot lockdown for lateral movement	• The weight of the shoe might increase
INSOLE	• Anti-slip resistant lined insole grips the foot in place	• Better grip to prevent pronation	• Removable and washable • Textured insole with proper zoning • Arch support	• Too much texture might rub along the Lower foot
MIDSOLE	• Compression molded EVA • Lightweight cushioning	• No arch support	• Better arch and lateral support	• Highly soft and cushioned midsole might affect the speed
OUTSOLE & SPIKES	• 7/4 spike alignment • 2mm high TPU lugs • 5mm lugs on the perimeter of outsole to enhance grip and traction in delivery stride	• No lateral support	• Zoned tread pattern	• This may sacrifice the speed

Metrics to Test

'How Could We' Statement

How could we design cricket shoes for two-player positions: bowler and batter that helps with heel and ankle stability and equal distribution of ground reaction forces (cushioning) upon landing in fast bowlers and lateral support, better traction, and protection against the ball for the batter?

Testing Metrics

The four metrics to test the current products will be traction, cushioning, lateral stability, and heel&ankle stability. Testing will be done on male athletes who play on national and/or international levels that have enough experience playing this sport. Athletes participating in this testing will be bowlers, batters, and all-rounders. Testing will be conducted on a natural grass pitch.

Testing Plans

Testing Plan for Bowler

PRODUCTS BEING TESTED: Benchmarked products

LOCATION: USA Cricket,
1 First Street, Unit 7 Los Altos CA 94022

TESTING ENVIRONMENT: Outdoor, natural grass playing field/pitch, daylight, warm temperatures

THINGS TO CARRY AT THE TESTING LOCATION:
- Testing products
- Consent forms
- Additional pair of socks
- Camera to capture movements

THINGS FOR PARTICIPANTS TO BRING:
The participants will be asked to come in their training/ match apparel top, bottom, footwear, and socks along with their sports equipment such as a ball for the bowler.

NUMBER OF PARTICIPANTS:
Ideally 8-10 bowlers will participate in this testing. The number of participants might change based on the availability of the athletes.

TESTING GOALS	PLAN	DOCUMENTATION	DURATION
Paperwork	• Each participant will be asked to sign a consent form along with some background information of the athlete	• Consent form	5 mins
Product review	• Each participant will be asked to rate the baseline products handed to them on a scale of 1-10 based on appearance, fit, performance, comfort and other parameters	• Product-review form	5 mins
Product fit & feel testing	• Each participant will be asked to try on the footwear and rate/provide feedback on fit, breathability, comfort, traction, foot lockdown and heel/ankle support	• Ratings - form/ rate cards • Feedback/comments- voice notes	8-10 mins
Performance testing	• Traction / Cushioning test: Each participant will be asked to perform sprint run-ups with different styles of bowling delivery X6 times • Heel& Ankle stability + Foot lockdown: Each participant will be asked to perform sprint run-ups with different styles of bowling delivery X6 times	• Video and pressure insoles • Video documentation for foot movement and voice notes for review	10-12 mins
Test completion	• Additional feedback and reviews regarding the test and the baseline products will be collected	• Feedback form	5 mins

Testing Plan for Batter

PRODUCTS BEING TESTED: Benchmarked products

LOCATION: USA Cricket,
1 First Street, Unit 7 Los Altos CA 94022

TESTING ENVIRONMENT: Outdoor, natural grass playing field/pitch, daylight, warm temperatures

THINGS TO CARRY AT THE TESTING LOCATION:

- Testing products
- Consent forms
- Additional pair of socks
- Camera to capture movements

THINGS FOR PARTICIPANTS TO BRING:
The participants will be asked to come in their training/ match apparel top, bottom, footwear, and socks along with their sports equipment such as shin pads, gloves, helmet and a bat.

NUMBER OF PARTICIPANTS:
Ideally 8-10 batters will participate in this testing. The number of participants might change based on the availability of the athletes.

TESTING GOALS	PLAN	DOCUMENTATION	DURATION
Paperwork	• Each participant will be asked to sign a consent form along with some background information of the athlete	• Consent form	5 mins
Product review	• Each participant will be asked to rate the baseline products handed to them on a scale of 1-10 based on appearance, fit, performance, comfort and other parameters	• Product-review form	5 mins
Product fit & feel testing	• Each participant will be asked to try on the footwear and rate/provide feedback on fit, breathability, comfort, traction, foot lockdown and lateral stability	• Ratings - form/ rate cards • Feedback/comments- voice notes	8-10 mins
Performance testing	• Traction / Cushioning test: Each participant will be asked to hit the ball and run in between the wickets • Lateral foot stability: Each participant will be asked to hit the ball as far as they can in their preferred batting stance to different types of ball deliveries X 6 times	• Video and pressure insoles • Video documentation for foot movement and voice notes for review	10-12 mins
Test completion	• Additional feedback and reviews regarding the test and the baseline products will be collected	• Feedback form	5 mins

The Testing Plan Involving Coaches and Trainers

Method 1: Interview

The coaches will be interviewed on athlete needs and performance factors, the importance of choosing the right equipment, and how it affects their game and play strategy.

Interview Questions

1) What are the most important considerations for choosing the proper cricket footwear?
2) What elements of the current design are missing or can be improved?
3) What type of footwear do these athletes wear while training indoors?
4) What type of footwear do these athletes wear while training outdoors?
5) How does wearing the right cricket shoe while playing affect the athlete's performance?
6) Are the athletes prone to any injury while training? If so, could you please elaborate?
7) What kinds of injuries are these athletes prone to while playing matches?
8) According to you, what could be the cause of these injuries? Is it the batting stance, the bowler's sprint, or other performance factors?
9) What is the significant difference between the injuries faced by a Bowler and a Batter?

10) According to you, what would an ideal cricket shoe look like?

Method 2: Product Reviews

Every coach and trainer will be handed the benchmark products and a rate card. They will be asked to rate every product based on various performance factors, fit, and comfort.

Methods of Collecting Data (Bowler and Batter)

Method 1: Product Review Cards and Questionnaire

Each athlete will rate and review the current benchmark products on review cards based on multiple performance metrics such as traction, cushioning, ankle support, lateral stability, etc. After analyzing these insights from each athlete, a standard matrix will be created, which will be an essential part of the ideation, design, and prototyping phase.

Method 2: Foot Pressure Analysis

While testing each of these benchmarked products, a pressure insole will be attached to every shoe to analyze the strain points, which will be considered while designing. The pressure point analysis for each of these athletes will be different. Therefore, common pressure points in each of the data collected will be taken into consideration.

Method 3: Upper Wear Analysis

While testing each of these benchmarking products, the zones prone to maximum wear will be marked; each zone can be color-coded or darkened based on how standard that wear zone is.

Method 4: Motion Capture

While testing these benchmarking products, the data will be captured in the form of videos and images to understand the footwork of these athletes for both the player positions as well as capture maximum impact zones.

The data for each of these athletes will be different. Hence average of all the data collected will be taken into consideration.

Data Interpretation (Bowler and Batter)

The initial data collected using the Product review cards and questionnaire will help analyze the shoe design holistically. The users will rate each benchmarked product based on specific parameters such as cushioning, traction, stability, and protection, the focus areas of this project. The product reviews provided by these users will set a good foundation base in terms of which parts of the shoes need a completely new design, features that require minor changes/updates, parts of the shoe that need a material switch, and parts that are less important and require the least focus, etc. This will set the base design parameters and focus goals and using these parameters and the SWOT analysis; I will be building a new shoe design concept.

The foot pressure analysis test results will help determine the entire insole, midsole, and outsole design. Especially bowlers need the right amount of cushioning while making the sprint before delivering the ball, but too much cushioning might create a more significant bounce effect, slowing them down and affecting their bowling delivery. The foot pressure analysis results will determine the areas of maximum impact, which will define the design of the sole footbed. These results can also determine if the insole needs some added texture to minimize the effect on the foot.

The upper wear analysis test results will define the use of materials for the upper. The areas more prone to wear can be replaced with better durable materials.

The data derived from the motion capture test will be used to analyze footwork and foot behavior, such as pronation, ankle sprain, and forefoot drag in the case of a batter's shoe. This

will help define design parameters such as whether the shoe needs to have a low cut or mid-cut, the position of the ankle strap for foot lockdown, and the width of the ankle strap for foot lockdown based on how stable the foot needs to be inside the shoe, etc.

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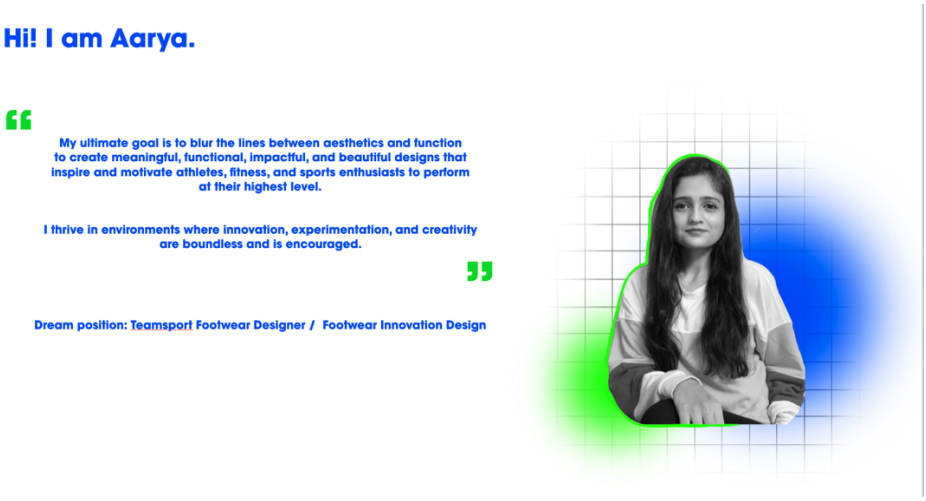
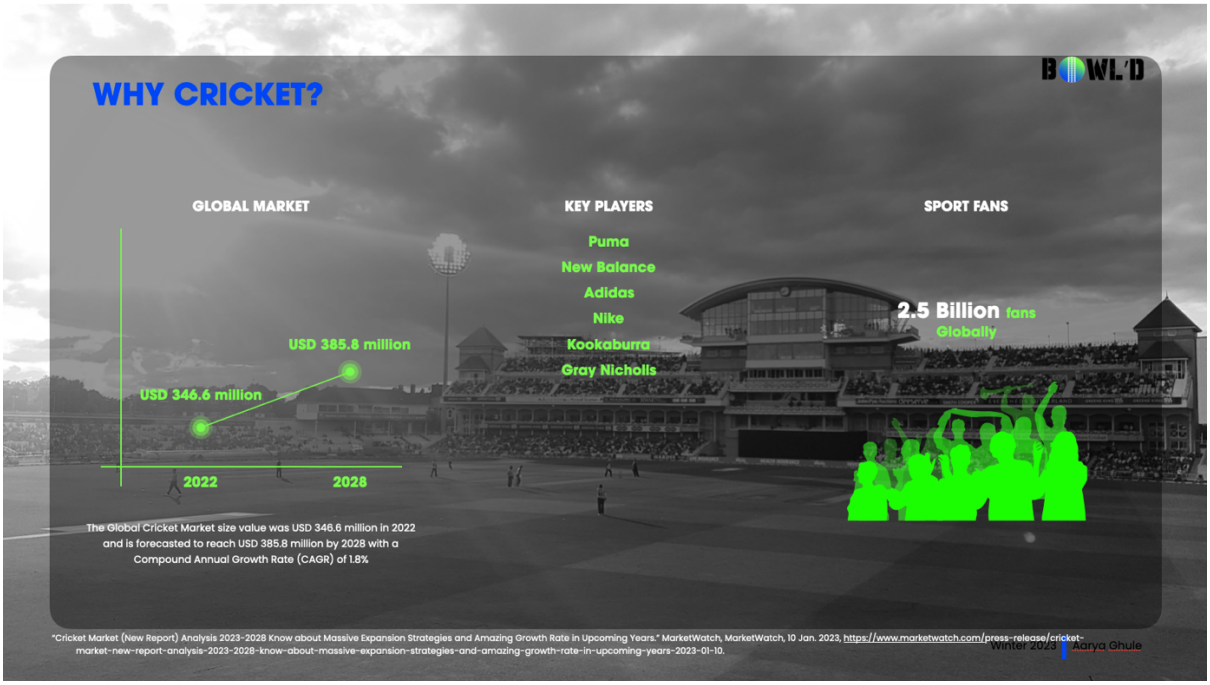
Winter Term (SPD 688)

The Winter term was about the development of the product collection which majorly focused on the 'works-like' model of the final collection as well as creating some aesthetic direction. This term heavily emphasized testing baseline products and improving the design direction for the new product collection.

Introduction / Background





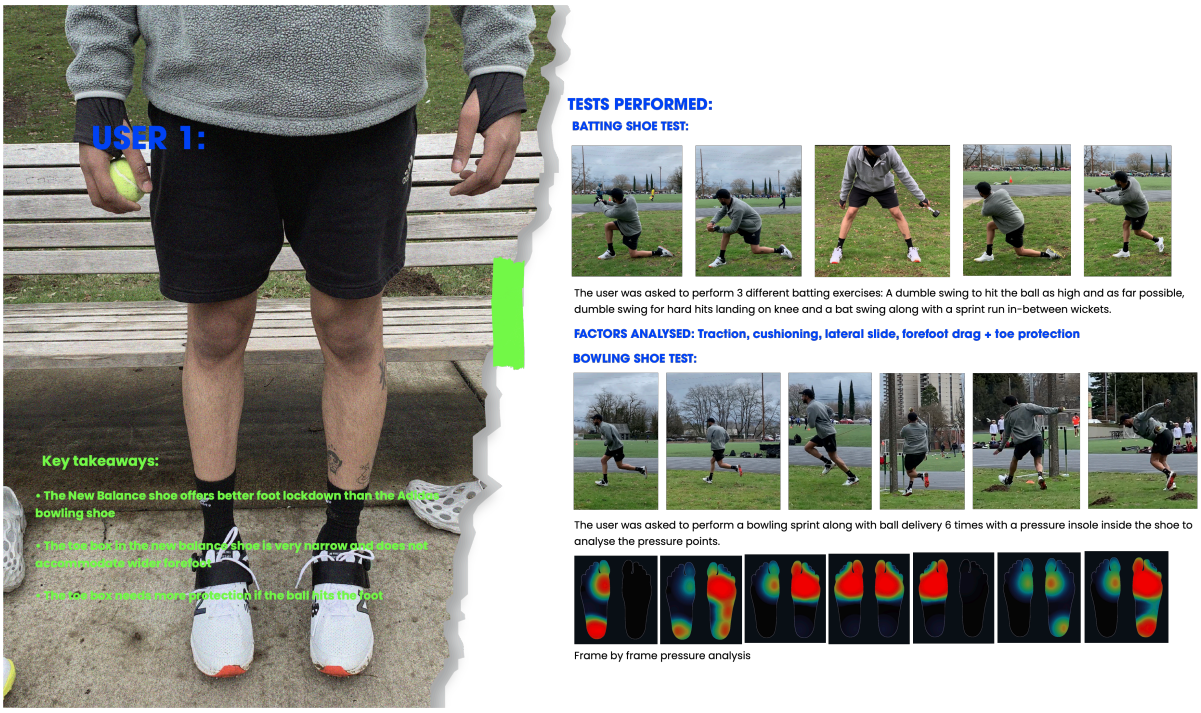
Baseline Products

4 top competitor products of two different brands: New Balance and Adidas were chosen as the baseline products. Out of which two were bowler shoes and two were batsman shoes. The bowling shoes were the Adidas Vector Mid Bowling and New Balance CK4040, and the batsman shoes were Adidas 22 YDS Full Spike II and New Balance CK4030. Both these product categories had separate testing matrices and data collection based on the player-specific movements.

Baseline Product Testing

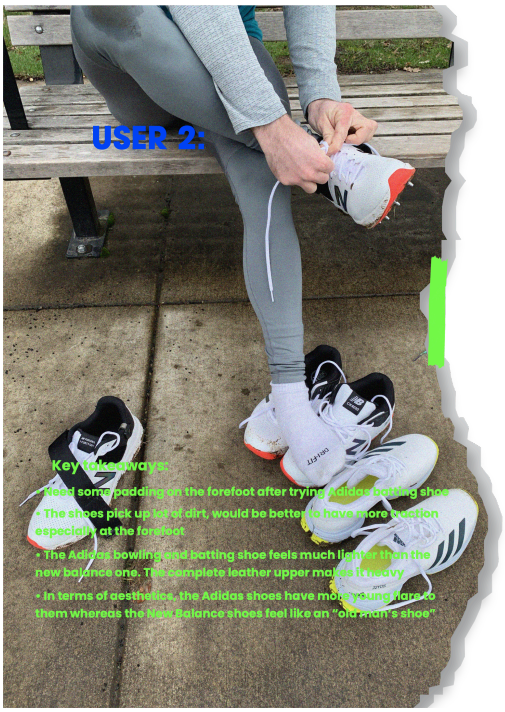
User Testing 1

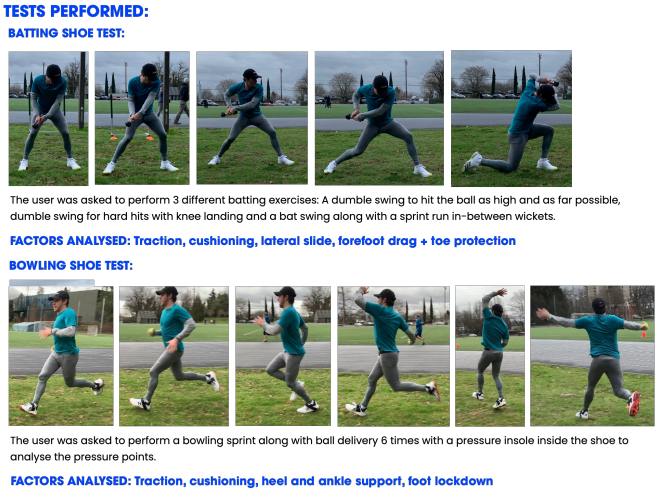
The user was asked to perform two different tests where one was specific to bowler movements, and one was specific to the batsman movements. In the bowler-specific test, a pressure insole was placed inside both the baseline products and the user was asked to perform a bowling sprint with ball delivery 6 times since in the actual sports environment, the bowler must bowl 6 times which makes up an over. The frame-by-frame pressure data of the foot was collected to understand the high-impact zones of the underfoot which would help in designing a better heel-toe drop cushioning system. In the second test which was specific to the batsman, the user was asked to perform three different batting exercises which are the most common movements a batsman must perform when playing a cricket match. The key takeaways post-testing was recorded.



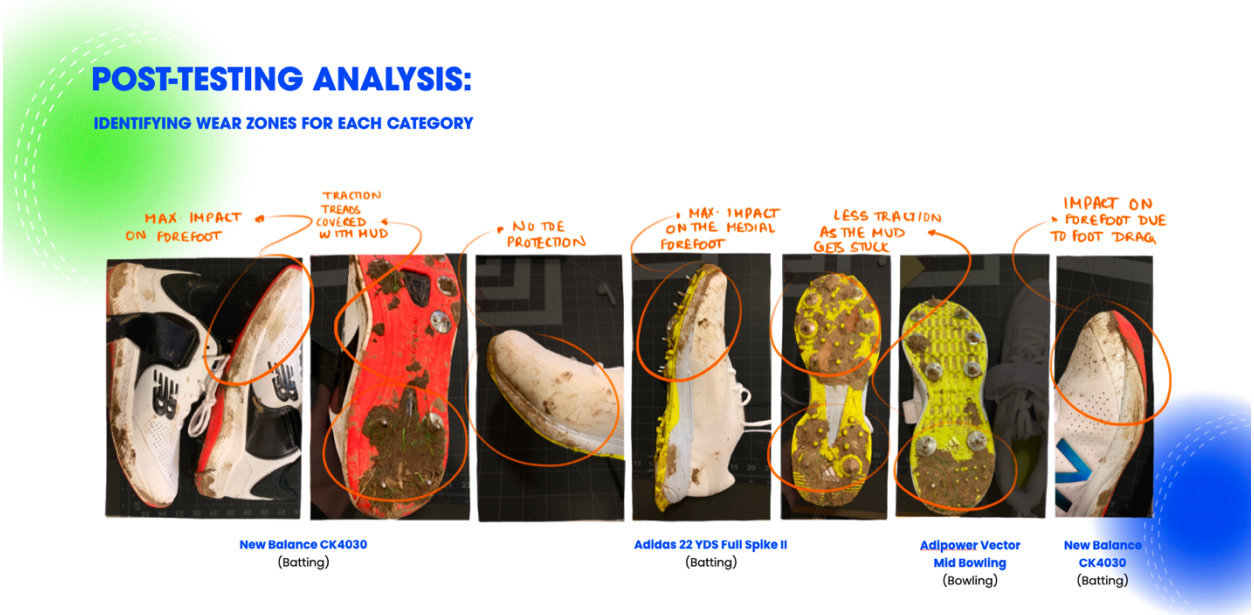
User Testing 2

Like user 1, user 2 was asked to perform similar movements and had to undergo the same bowler-specific and batsman-specific tests, and the key takeaways post-testing were recorded.





Post-Testing Wear Analysis



Post-Testing Product Feedback

A scorecard for all 4 baseline products was shared with the users and they were asked to rate the products based on 4 factors: Fit & Comfort, Traction, Cushioning, Foot Lockdown + Heel, and Ankle Stability.

PRODUCT FEEDBACK:

POST TESTING SUBJECTIVE FEEDBACK: SCORE CARD

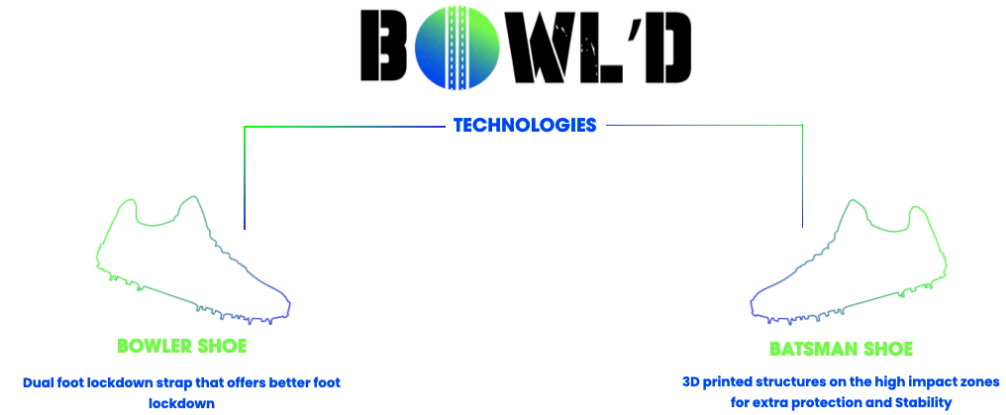
** Each score is out of 5	Adidas 22 YDS Full Spike II (Batting)	New Balance CK4030 (Batting)	Adipower Vector Mid Bowling (Bowling)	New Balance CK4040 (Bowling)
FIT & COMFORT	3	2	4	4
TRACTION	2	4	4	4
CUSHIONING	2	3	5	2
FOOT LOCKDOWN + HEEL & ANKLE STABILITY	✗	✗	2	5
TOTAL				

Problem Statement

HOW CAN WE DESIGN CRICKET FOOTWEAR FOR BOWLERS AND BATSMEN THAT FOCUSES ON BETTER FOOT LOCKDOWN, TRACTION AND IMPACT PROTECTION (TOE PROTECTION)

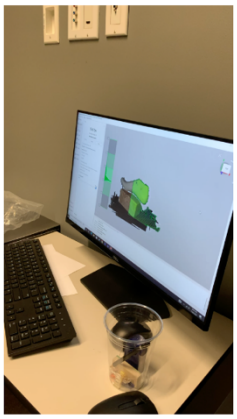
Product Collection

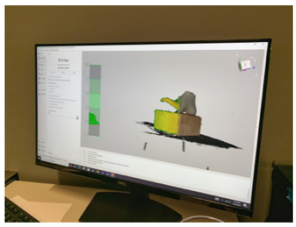
Platform Technologies

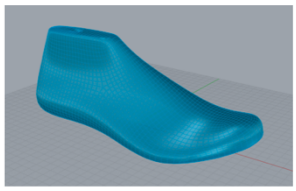


Bowl'd Last: Cricket Specific Last

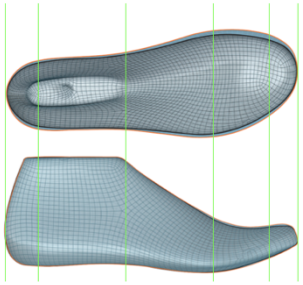
Most of the cricket shoes in the market are built off a running shoe last. Based on the online survey most of these athletes especially in certain parts of Australia and Asia have wider forefoot. Most running shoes last having narrow forefeet fail to accommodate users with wider feet. Hence for the Bowl'd performance cricket shoe collection, a custom cricket shoe last was built using a running shoe last as a base reference. Major changes were done in the ball girth measurements and the toe height was increased by a few millimeters to prevent the issue of the toe rubbing by providing more room in the toe box region.







Modifying scanned shoe last digitally



Custom cricket shoe last

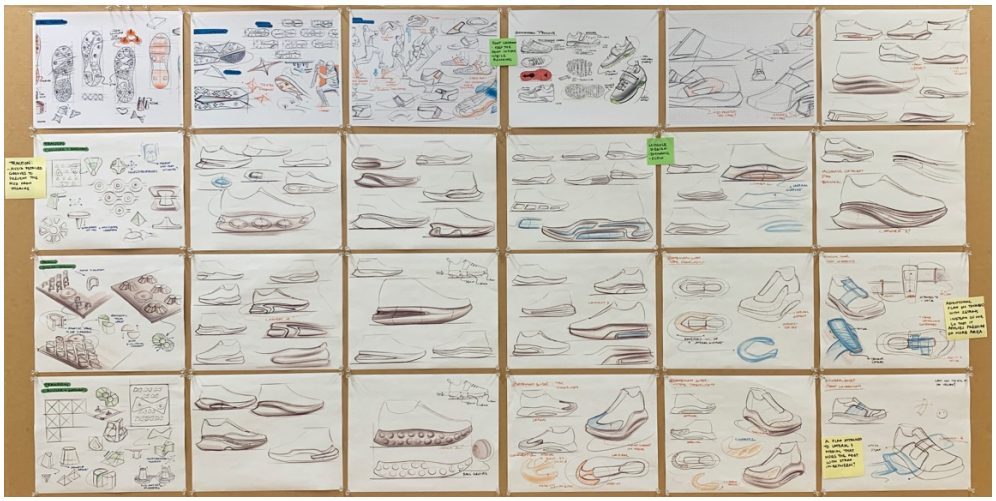
NEW DIMENSIONS:

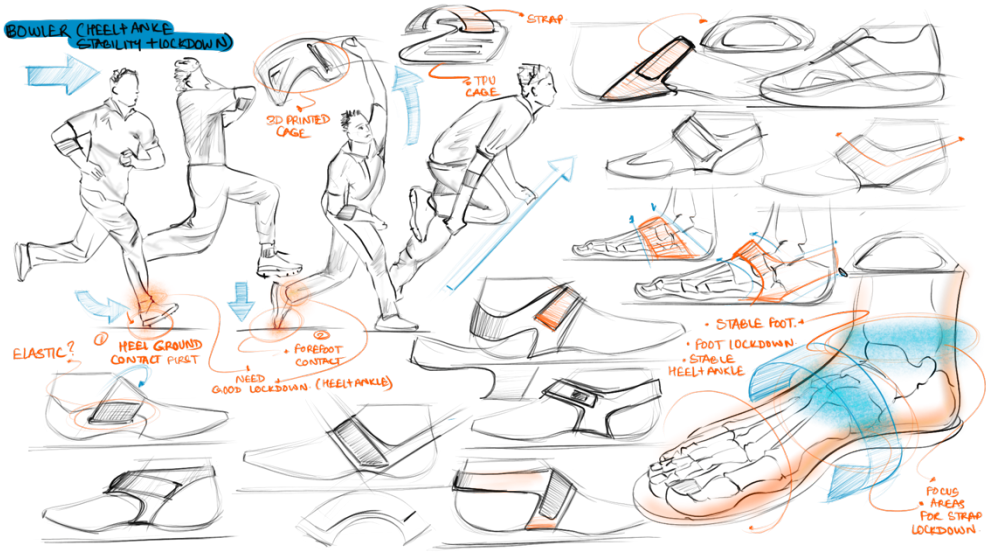
Last Size: Men's USA 10.0
Last length: 294.2mm
Ball Girth: (EE) 257.2mm

Men's 9D running Shoe last

Men's 10 EE cricket shoe Last

Ideation





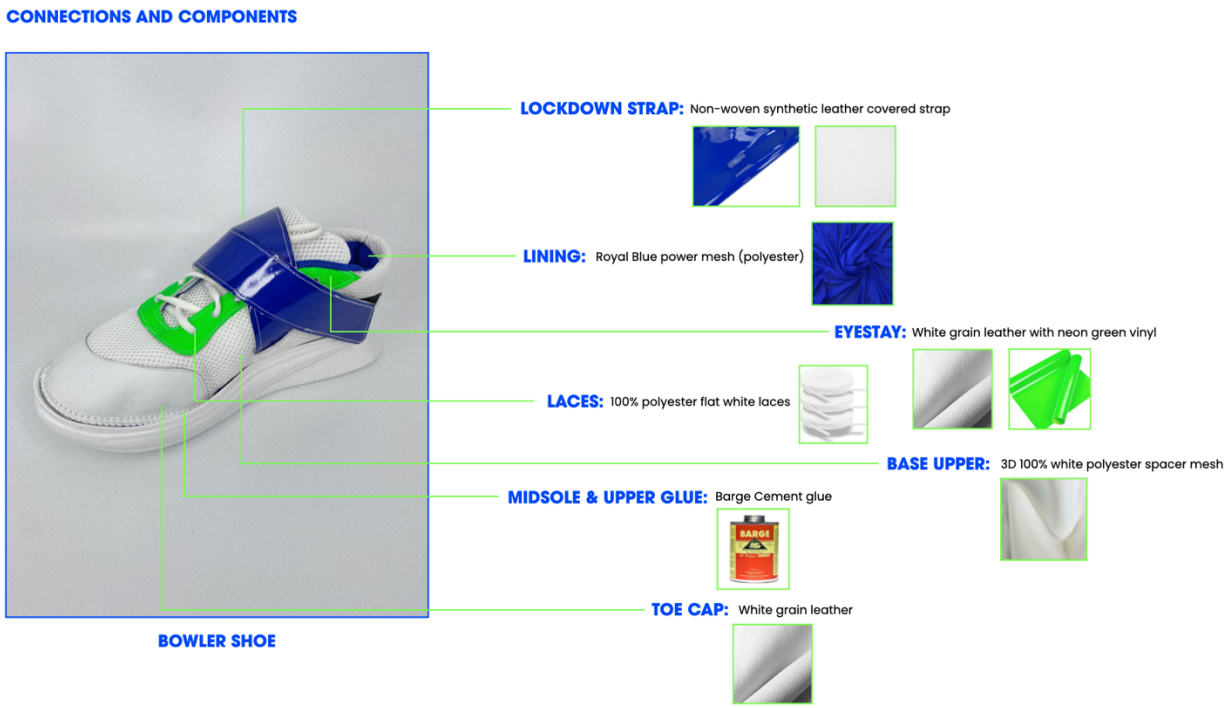
Prototyping

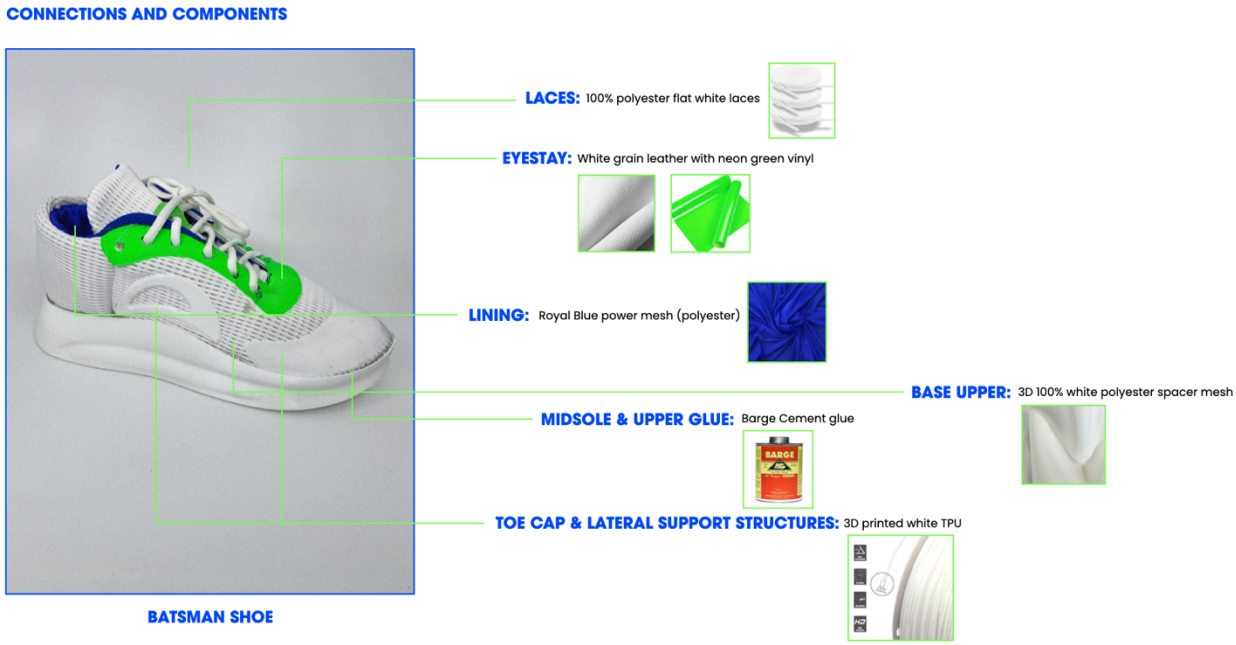
PROTOTYPING (Upper pattern + traction swatches + midsole)

PROTOTYPING (Bowler shoe)

PROTOTYPING (Batsman shoe)

Materials and Component Connections

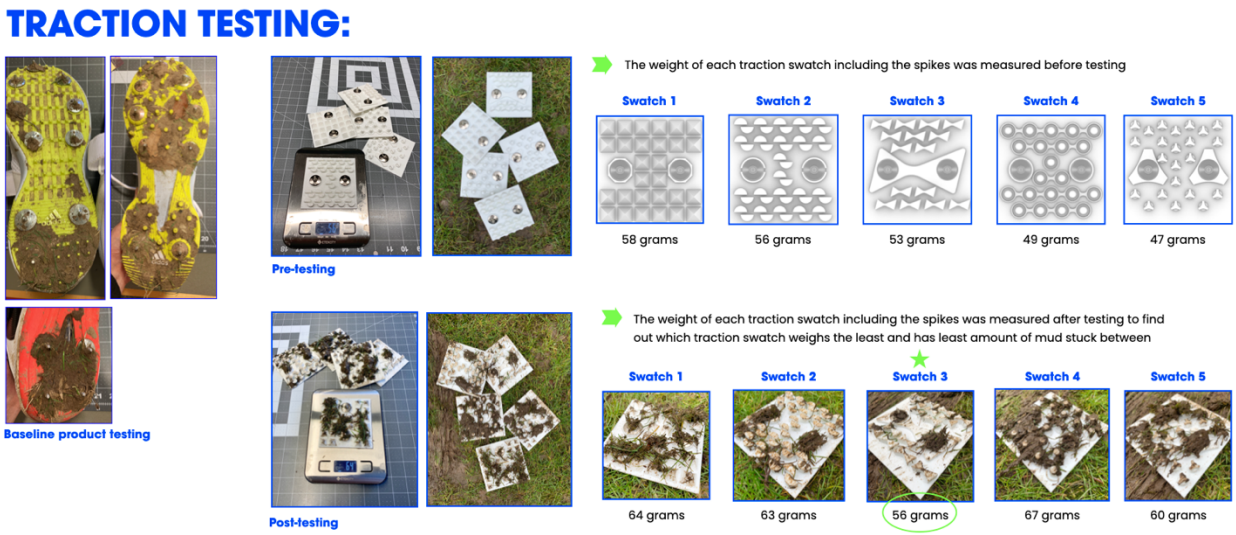




Product Testing

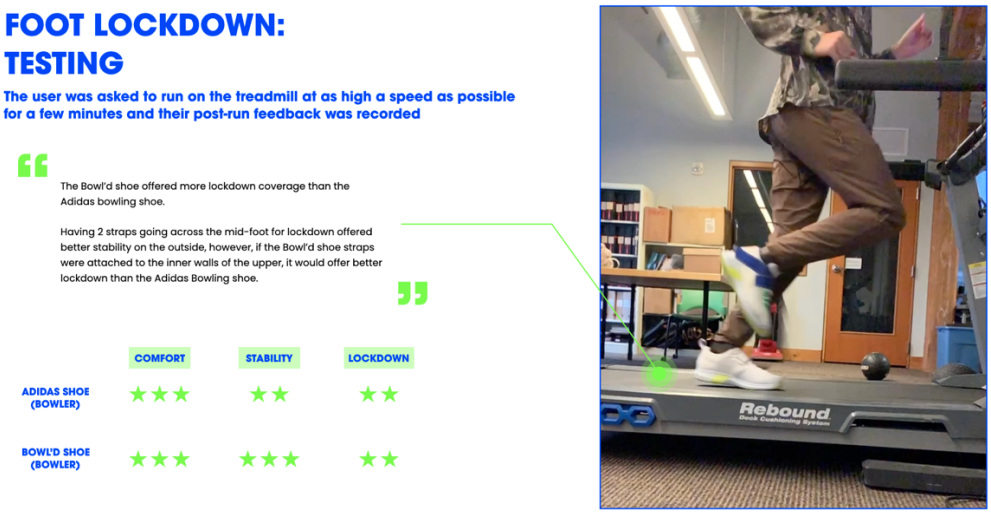
Traction Testing

The main aim of the traction testing was to determine which tread pattern offers better traction alongside the existing metal spikes and catches the least amount of mud and dirt which was a major issue with the baseline products. In this testing, 5 different 10cmX10cm swatches of tread patterns were rubbed against the damp grass field at high forces and the mud accumulation in each swatch was documented. Each swatch was weighed on a weighing scale pre and post-testing to determine which traction pattern weighs least whilst providing good traction.



Foot Lockdown Testing

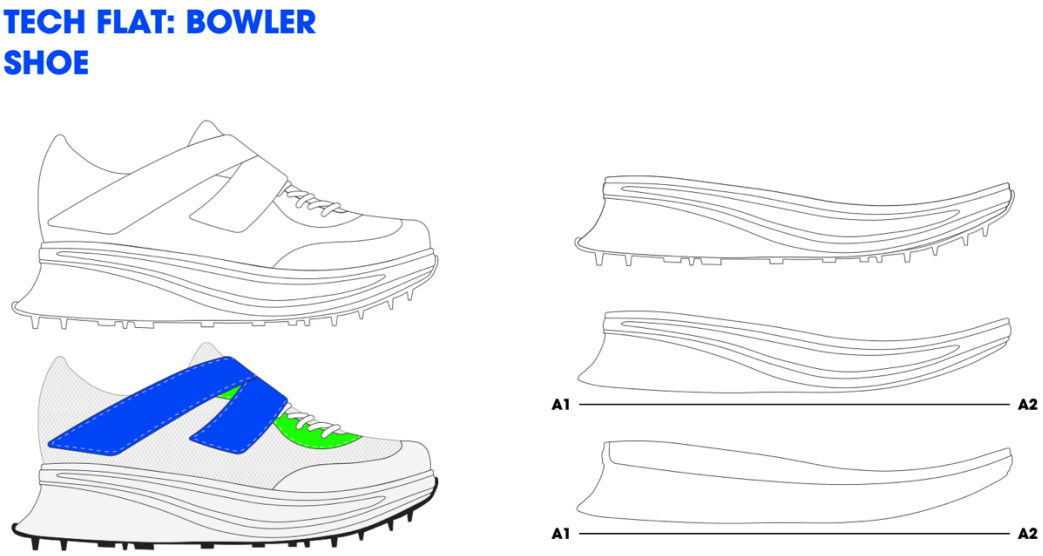
To test the foot lockdown provided by the Bowl'd bowling shoe, the user was asked to run on a treadmill for a few minutes at high speed possible and their feedback post-testing was recorded. Due to the dual strap foot lockdown, the bowl'd shoe offered better lockdown coverage than the Adidas Adipower Vector Mid Bowling shoe.



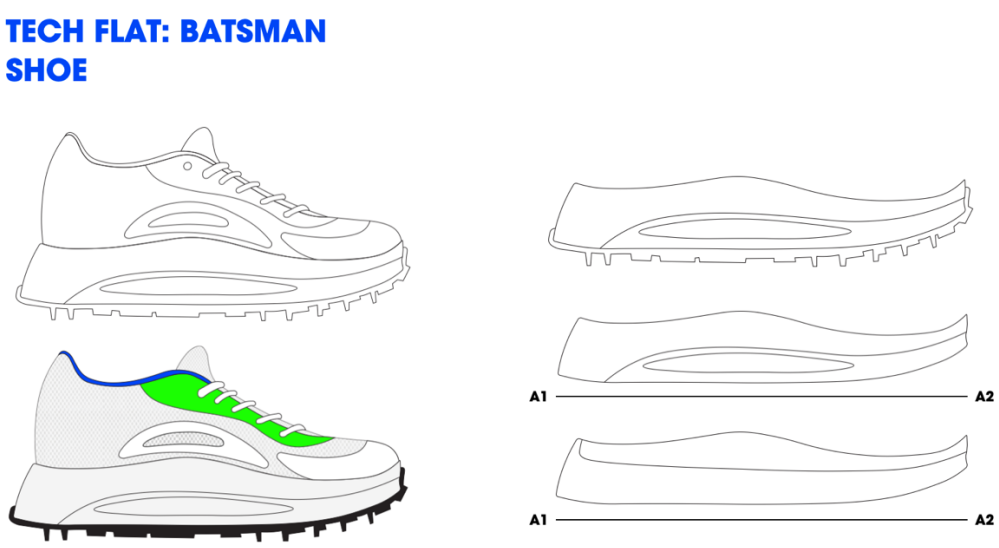
Impact Testing for Toe Protection

For the batsman, the shoe having good toe protection against the ball and constant shoe drag while hitting is extremely essential. In this impact testing, 2 clay cylinders were placed inside the Adidas 22 YDS Full Spike II and the Bowl'd Batsman shoe toe box. A steel ball weighing approximately 226 grams was dropped from a certain height onto the toe box of both these shoes and the change in the height of the clay cylinder was recorded. The Bowl'd Batsman Shoe took less impact as the change in the clay cylinder height was 0.31mm while the Adidas Batsman shoe took comparatively higher impact where the change in clay height was 0.48mm.

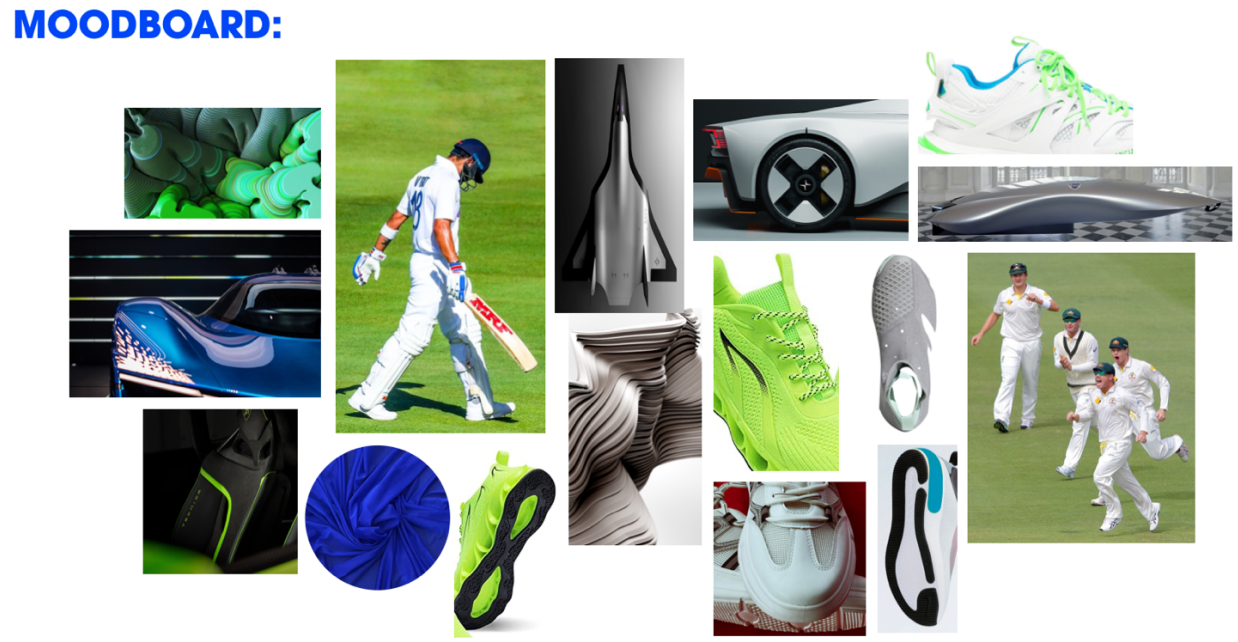
Tech Flat: Bowl'd Bowling Shoe

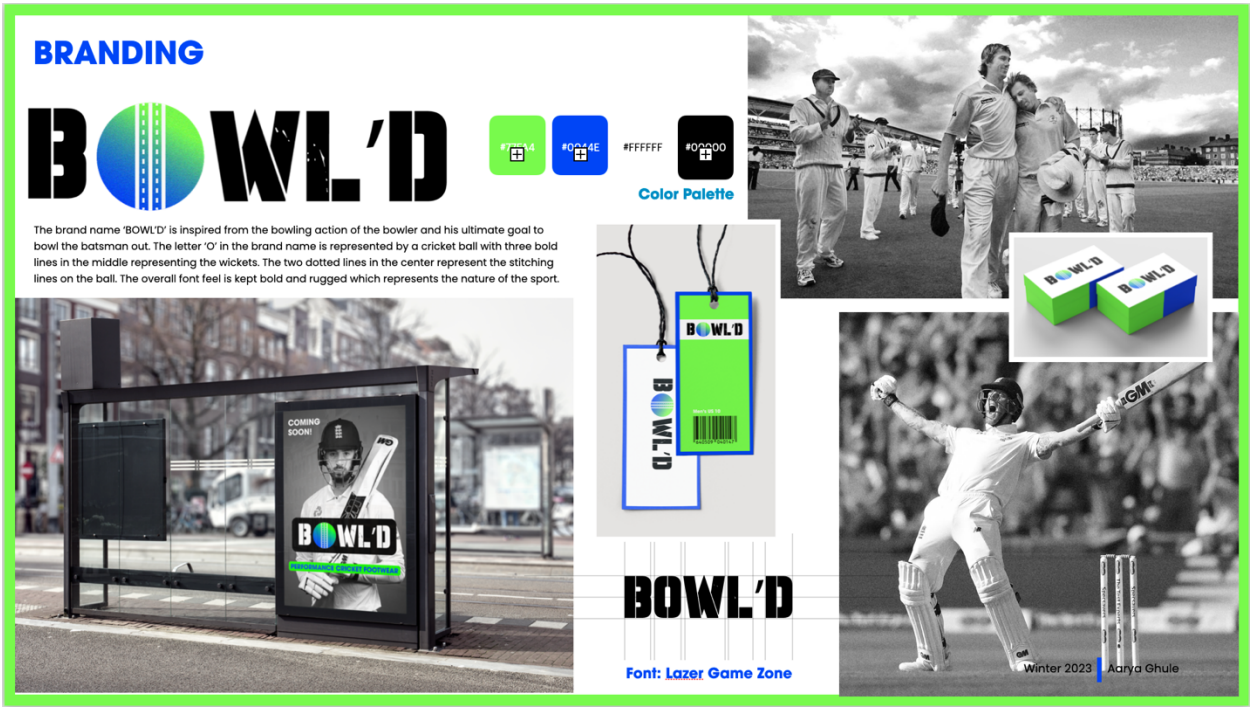


Tech Flat: Bowl'd Batsman Shoe



Aesthetic Direction





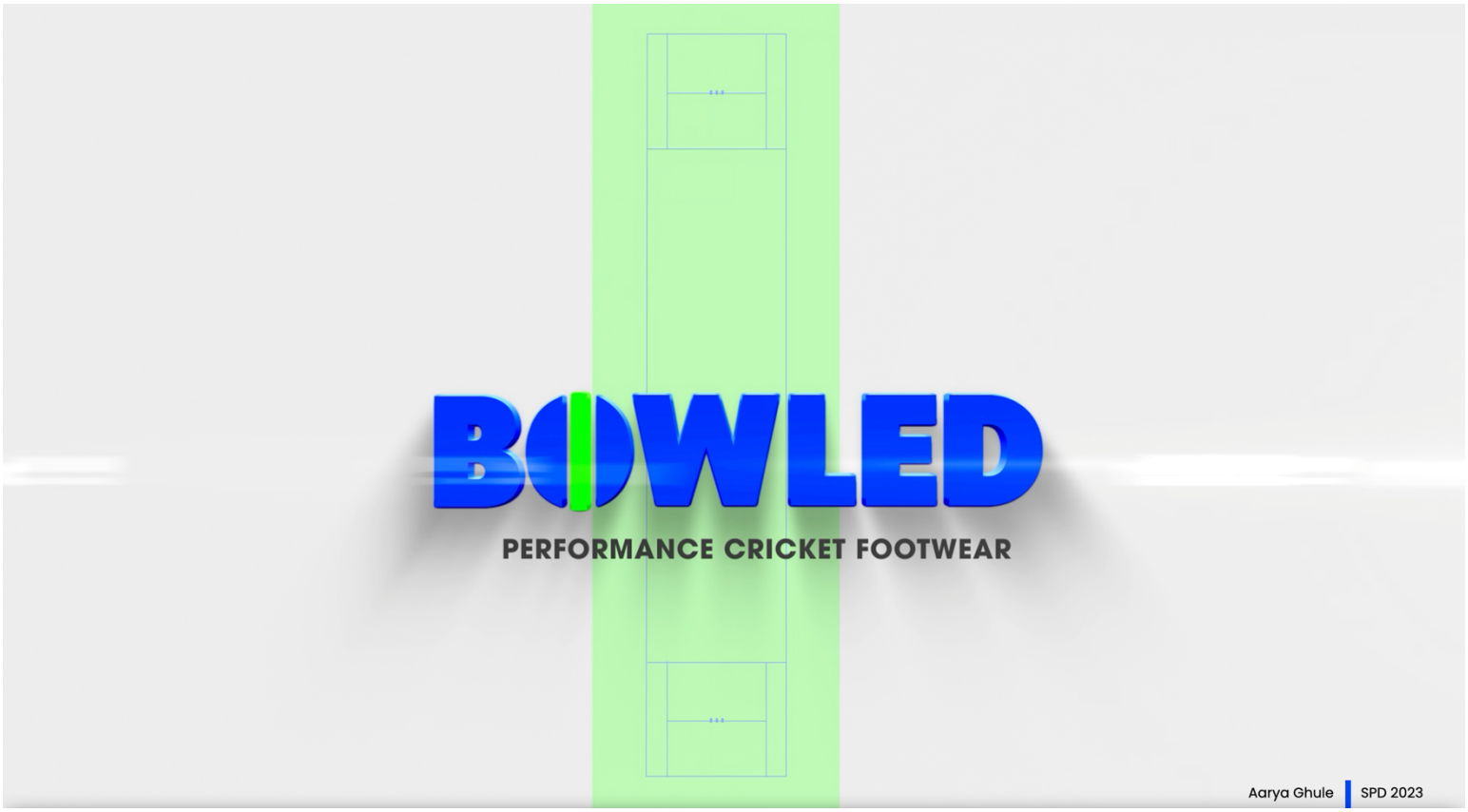
Next Steps

PLANS FOR LOOKS LIKE PROTO:

- I feel pretty confident about the innovation and platform technology that I designed this term as well as testing to some extent. However, I plan to do more testing with the same innovation next term in actual environment and try contacting some athletes to participate in the testing.
- I will be talking to a professional Australian Cricketer to gather some insights specifically on the aesthetics, trends, design language, and preferences of the shoe among professional cricketers.
- In the initial few days, I just want to just focus on the design language and form of the shoe and get that right before jumping into the final color and materials palette.
- Once my design for both the bowler and the batsman shoe is finalized, I will be choosing my final materials and color palette. In the meantime I will also be contacting the local cricket clubs and athletes for testing and validation.
- Once my design for both the bowler and the batsman shoe is finalized, I will be choosing my final materials and color palette. In the meantime I will also be contacting the local cricket clubs and athletes for testing and validation.
- Once I have my final looks like protos, I will be focusing on developing 3d models, renders, tooling drawings, and tech flats for the upper as well as the branding and the packaging.

Spring Term (SPD 689)

The Spring term focused on developing the entire product collection after analyzing the testing insights in the winter term, finalizing the aesthetic direction, and materials to build the final products as well as testing and validating the products from athletes.


BOWLED
PERFORMANCE CRICKET FOOTWEAR
Aarya Ghule
SPD 2023


WHY CRICKET?
Second most popular sport in the world
2.5 billion cricket fans worldwide
4200 professional cricketers and 30 million registered amateur cricket players worldwide
Aarya Ghule
SPD 2023

BOWLER INSIGHTS

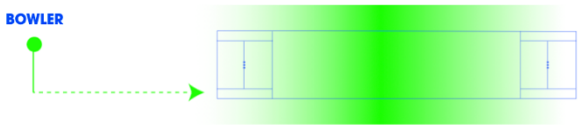
FOOT LOCKDOWN + TRACTION & CUSHIONING

FROM AN ONLINE SURVEY OF 13 PROFESSIONAL CRICKETERS OUT OF WHICH 6 WERE BOWLERS

"NEED A SOLID GRIP WHILE LANDING"

"NEED INCREASED ANKLE SUPPORT (BOOTSTRAP + LACES) AND COMFORT"

"PREFER TO WEAR LIGHTWEIGHT SHOES AS WE HAVE TO WEAR THEM FOR LONG HOURS AND SPRINT IN THEM. SO I NEED SOMETHING THAT DOES NOT MAKE MY LEGS FEEL HEAVY"



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BATSMEN INSIGHTS

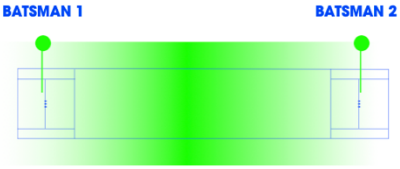
IMPACT PROTECTION + TRACTION & CUSHIONING

FROM AN ONLINE SURVEY OF 13 PROFESSIONAL CRICKETERS OUT OF WHICH 7 WERE BATSMEN

"NEED BETTER TOE GUARD FOR CONSTANT SHOE DRAG"

"EXTRA SUPPORT UNDER THE BALL OF THE FOOT FOR CONSTANT TURNING AND PIVOTING"

"YOU CAN START FEELING THE SPIKE FORMATION UNDER THE FOOT AS YOU WALK, INSTEAD OF AN EVEN FLAT SPREAD OF FORCE THROUGHOUT THE SOLE WHICH IS UNCOMFORTABLE"



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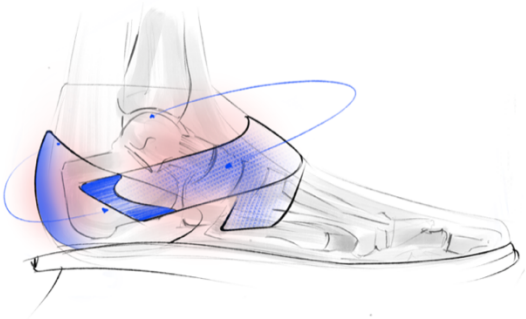
GOAL

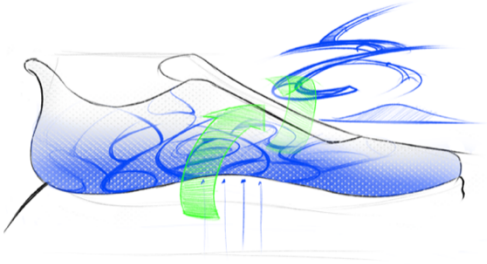
HOW CAN WE DESIGN PERFORMANCE CRICKET FOOTWEAR FOR BOWLERS AND BATSMEN THAT FOCUSES ON BETTER FOOT LOCKDOWN, TRACTION, CUSHIONING AND IMPACT PROTECTION

TECHNOLOGIES



LOCKED

Featuring dual strap lockdown feature that hugs the mid foot and locks it down with the help of reinforced heel counter



BARRICAGE

Featuring 3d printed tpu cage structure on the upper with with special zoning in terms of the thickness of the structure based on Amount of support needed in those areas

MOODBOARD

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IDEATION

MOMENTUM X : BOWLER SHOE

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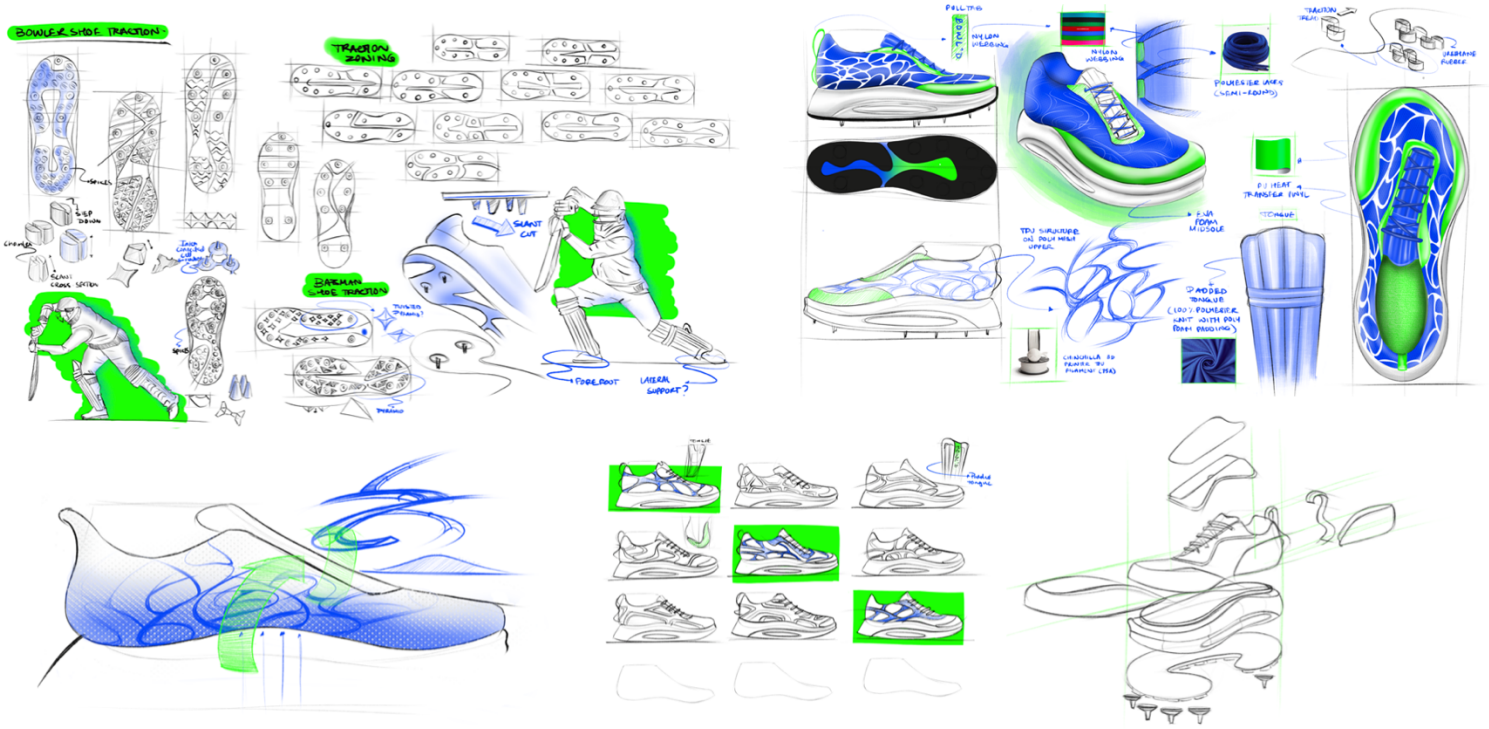
IDEATION



DEFENDER: BATSMAN SHOE

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FINAL CONCEPTS

MOMENTUM X

MADE FOR THE FASTEST BOWLERS

BY

BOWLED

DEFENDER

MADE FOR THE BIGGEST HITTERS

BY

BOWLED

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PROTOTYPING

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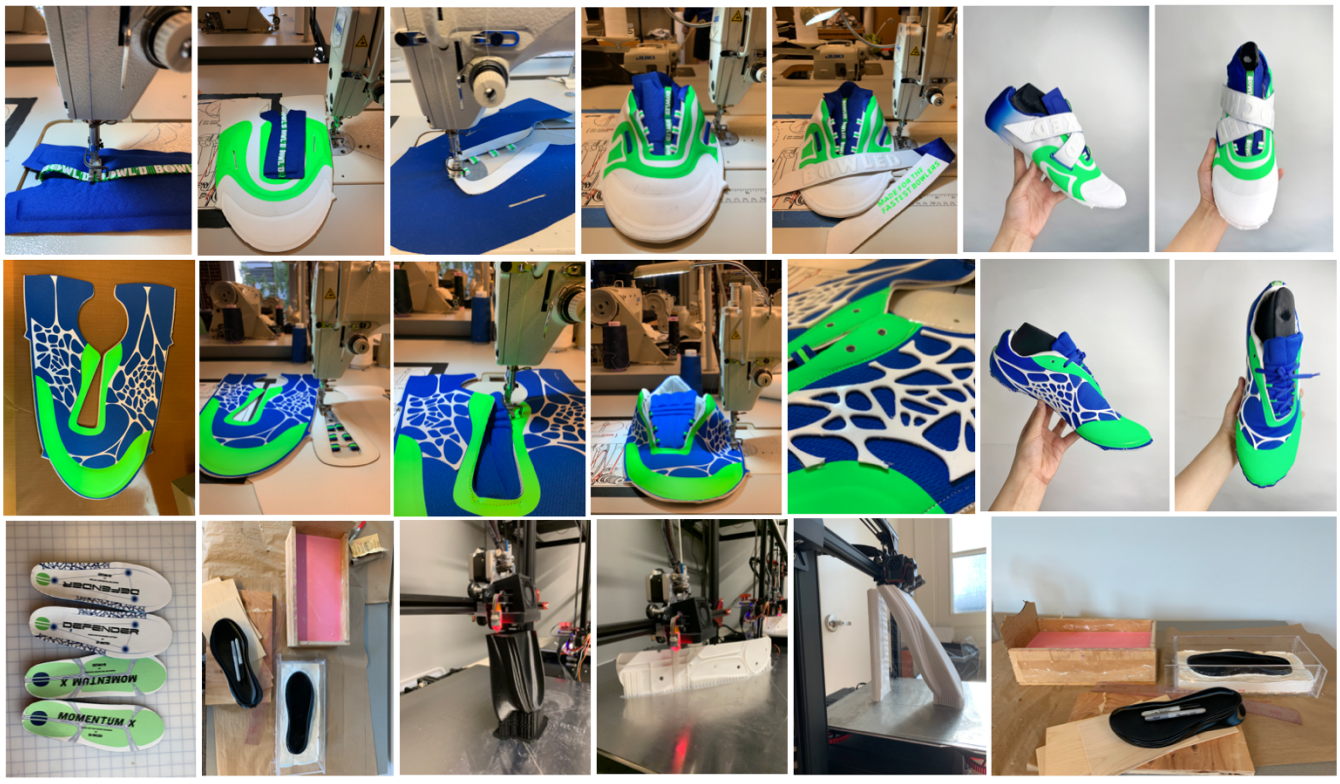

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MOMENTUM X

MADE FOR THE FASTEST BOWLERS

BY

BOWLED

FEATURES AND BENEFITS

Dual strap lockdown system, where the strap goes underneath the foot and wraps around it that not just provides a better lockdown but also gives the needed arch support

High-density Eva foam with a higher heel to toe drop than the competitor's products that provides just the right amount of cushioning without sacrificing the speed of the bowler

Zoned traction pattern on the outsole

Polyester spacer mesh upper with zoned TPU placement to provide rigidity to the upper in the mid-foot region

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DEFENDER

MADE FOR THE BIGGEST HITTERS

BY

BOWLED

FEATURES AND BENEFITS

3D Printed 85A shore TPU cage structure on the upper mesh to provide rigidity, stability and impact protection

Elevated midsole wall on the mid-foot region to prevent the foot slide during lateral cuts while batting

Asymmetric toe cap that provides more protection on the medial side of the foot to prevent the shoe from ripping apart due to constant toe drag

Zoned traction pattern on the outsole

An asymmetric tongue for improved fit and also reducing the pressure on the top of the foot as well as directs the motion of the batsman hitting the ball

Aarya Ghule | SPD 2023


ATHLETE VALIDATION
ATHLETES PLAYING AT THE SPECIFIC POSITIONS IN CRICKET I.E. THE BATSMAN AND THE BOWLER WERE ASKED TO PERFORM THEIR POSITION-SPECIFIC MOVEMENTS FOR A DURATION OF 20 MINS
"I can feel the foot lockdown strap under my arch and it provides good support and I can feel my ankle locked down both with the strap and the reinforced heel counter"
"I never thought just by changing the position of the toe cap slightly towards the inside of the foot can prevent the shoe from ripping"
"Having an asymmetric tongue design is such a good idea as there is already enough pressure caused by the batting pads"
Aarya Ghule | SPD 2023


Aarya Ghule | SPD 2023

Appendix A: Laws of Cricket

The Board of Cricket believes that the sport should be played according to the laws and within the spirit of Cricket. The primary responsibility of fair play lies with the captain and extends to all the players, match officials, and coaches. Respect is the central part of the spirit of cricket. They respect the team captain and their decisions, teammates, opponents, and the umpires' authority. The players must respect and accept the umpire's decisions after a critical analysis of that decision. Creating a positive play environment and encouraging others is highly encouraged. At the end of each game, in the spirit of sportsmanship, the players and the captain should congratulate the opposition on their success and enjoy those of their team, as well as thank the officials and the opposition at the end of the match, irrespective of the result. The Board believes that Cricket is an exciting game that encourages leadership, friendship, and teamwork, which brings people from different nationalities, cultures, and religions together, especially when played within the Spirit of Cricket. (Preamble To The Laws: Spirit Of Cricket , n.d.)

Law 1: The Players

Every cricket match is played between two sides, each consisting of eleven players, one of whom is the team's captain. In exceptional circumstances, by agreement, a match can be played between teams with fewer than standard eleven players but not more than that. Suppose during the game, for whatever reason, a team has less than the original number of players nominated. In that case, the match shall continue, if possible, under the Laws or any agreements made before the toss. Each captain must select their players in writing to one of the umpires before the toss. No player shall be replaced after the nomination without the consent of the opposing captain. The replacement must complete any penalty time, warnings, or suspensions

that are unserved by the original player to whom it is assigned. The captain of both teams is always responsible for ensuring that the play is fair and is conducted within the Spirit of Cricket. If the captain is unavailable, the deputy shall act instead. (Law 1: The Players, n.d.)

Law 2: The Umpires

Before the match, two umpires shall be appointed before the battle to control the competition and ensure the game is played within the laws and with absolute impartiality. The umpires must be present on the ground and report to the Executive of the land at least 45 mins before the start of the match. Only under exceptional circumstances are the umpires changed. Before the toss of the game, the umpires shall determine the balls to be used during the game, the hours of play, and the times and duration of any agreed intervals. Also, before the toss and during the game, the umpire must ensure the wickets are properly pitched and the creases are marked correctly. The referees are the judges of fair and unfair play during the game. They must also follow a specific signal code to determine the ball's outcome once the bowler delivers. (Law 2: The Umpires, n.d.)

Law 3: The Scorers

The board appoints two scorers to record all the runs scored, all wickets taken, and the appropriate number of bowled overs. It is their job to check in to ensure the records match frequently. Also, they must accept all the instructions and signals given to them by the umpires and immediately acknowledge each call. (Law 3: The Scorers, n.d.)

Law 4: The Ball

The ball used in a match shall not exceed 5.5 ounces / 155.9g and 5.75 ounces / 163 g and shall not measure less than 8.81in/22.4cm nor more than 9in/22.9cm in circumference. All balls used in the match must be determined by the umpires and shall remain in their possession before

the toss. During Test Cricket and ODIs, the captain of the fielding side may demand a new ball after a certain number of overs. Also, if the ball cannot be found or recovered during the play, or the umpires agree that it has become unfit for the space, the umpires shall replace it with a ball that has had wear comparable to the previous hop that was being used. The size of the ball is different for Women's Cricket and Junior Cricket. (Law 4: The Ball, n.d.)

Law 5: The Bat

The bat consists of two parts, a handle, and a blade. The basic requirements and measurements with specific details are laid out, and the bat design should fit within this law. The bat handle is typically made of cane and wood. Only the upper portion of the handle is covered with a rubber grip. The blade consists of the whole bat apart from the handle and is entirely made of wood. (Law 5: The Bat, n.d.)

Law 6: The Pitch

The pitch is the rectangular area of the ground which is 22 yards/20.12m in length and 10ft/3.05 m in width. It has bowling creases on each end, and wickets pitched at a certain distance from this crease. The umpires are the sole judges of the fitness of the pitch for play. Before the match, the ground Authority shall be responsible for the pitch's selection and preparation; once the game begins, the umpires control its use and maintenance. (Law 6: The Pitch, n.d.)

Law 7: The Creases

All the positions of the bowling crease, popping crease, and two return creases are marked with white lines. The bowling crease is the back edge of the crease where the line marks the end of the pitch. The popping crease, which is also the back edge of the crease marking, is in front of and parallel to the bowling crease. The return crease is the inside edges of the crease

markings at right angles to the popping crease at 4 feet 4 inches/1.32m. (Law 7: The Creases, n.d.)

Law 8: The Wickets

There are two sets of wickets in Cricket pitched opposite and parallel to each other in the centers of the bowling creases. Each group is 9 inches/22.86cm wide and consists of three wooden stumps with two wooden bails on the top. (Law 8: The Wickets, n.d.)

Law 9: Preparation and maintenance of the playing area

During the match, the pitch may be rolled at the request of the captain of the batting team for up to 7 minutes. The rise shall be cleared of any debris found. Also, all the pitch mowing before a match is the sole responsibility of the Ground Authority. The pitch shall not be watered during the game. Lastly, the creases shall be re-marked whenever either of the umpires considers it necessary. (Law 9: Preparation And Maintenance Of The Playing Area, n.d.)

Law 10: Covering the pitch

The Ground Authority is responsible for putting covers on the pitch before the match. The whole angle and a minimum of 4 feet/1.22m beyond at each end must be covered. (Law 10: Covering The Pitch, n.d.)

Law 11: Intervals

An interval can be categorized into different classes, such as the period between the close of play on one day and the start of the next day's match, intervals between innings, meals, Intervals for drinks, or any agreed interval. (Law 11: Intervals, n.d.)

Law 12: Start of play; Cessation of play

The bowler's end umpire shall call Play before the first ball of the match and on the resumption of play after any interval or interruption. When the ball is dead at the end of any situation, the bowler's end umpire shall call time. Moreover, after the call of time, the bails shall be removed from both wickets. (Law 12: Start of Play; Cessation Of Play, n.d.)

Law 13: Innings

The match can be conducted in the format of one or two innings based on the agreement of each side before the game. However, the arrangements shall apply similarly to both innings in a one-inning match. Whereas in a two-inning round, similar contracts shall apply to the first innings of each side, the second innings of each side, or both innings of each side. (Law 13: Innings, n.d.)

Law 14: The Follow-On

In the case of Test Cricket, where the match consists of two innings of 5 days or more, the team that bats first leads by at least 200 runs shall have the option of making it a requirement for the other side to follow their innings. A similar option is available to two-inning matches of shorter duration with a minimum of 150 runs in 3 or 4 days, 100 runs in a 2-day game, and 75 runs in a 1-day tournament. (Law 14: The Follow-On, n.d.)

Law 15: Declaration and Forfeiture

At any time during the innings, when the ball is dead, the captain of the batting side may declare an inning closed. This said innings should be a completed inning. (Law 15: Declaration And Forfeiture, n.d.)

Law 16: The Result

The side which has scored a total of more runs than that scored in the two completed innings of the opposite side shall win the match. The side which has achieved in its one innings a total of runs more than that achieved by the opposing side in its one completed innings shall win the match. (Law 16: The Result, n.d.)

Law 17: The Over

The ball shall be bowled from each end alternately in overs of 6 balls. An over has started when the bowler begins their run-up. If there is no run-up, their action for the first delivery of that over starts. (Law 17: The Over, n.d.)

Law 18: Scoring Runs

Runs shall reckon a score. A run is scored. (Law 18: Scoring Runs, n.d.)

Law 19: Boundaries

Before the toss, the umpires shall determine the boundary of the field of play, which will be fixed for the entire match duration. The limit shall be defined so that no part of any sightscreen will be within the field of play at any match stage. (Law 19: Boundaries, n.d.)

Law 20: Dead Ball

The ball becomes dead when it is finally settled in the hands of the wicketkeeper or the bowler when a boundary is scored, i.e., runs scored from boundaries when a batter is dismissed if the ball gets trapped in the clothing or equipment of the batter of the clothing of the umpire. The final decision of the dead ball is made by the referee only. (Law 20: Dead Ball, n.d.)

Law 21: No Ball

The umpire shall ascertain whether the bowler intends to bowl right-handed or left-handed, over or round the wicket, and inform the striker. It is considered unfair if the bowler fails

to notify the umpire of a change in their delivery behavior. In this case, the referee shall declare it as no ball. (Law 21: No Ball, n.d.)

Law 22: Wide Ball

If the ball passes wide of where the striker is standing or has stood at any point after the ball came into play for that delivery, and which also would have passed wide of the striker standing in a normal batting position, it is considered a wide ball. The ultimate decision to declare it a wide ball lies with the umpire. (Law 22: Wide Ball, n.d.)

Law 23: Bye and Leg Bye

Suppose the ball, delivered by the bowler, not comprehensive, passes the striker without touching their bat or person. In that case, any runs completed by the batters from that delivery, or a boundary allowance, shall be credited as Byes to the batting side. Also, if the ball is no ball, a one-run penalty for such a delivery shall be incurred. (Law 23: Bye And Leg Bye, n.d.)

Law 24: Fielder's absence; Substitutes

If for any reason, a fielder has been injured or become ill during the match, the umpire shall allow a substitute fielder for that team. This substitute shall not bowl or act as captain but may act as wicketkeeper only with the consent of the umpire. (Law 24: Fielder's Absence; Substitutes, n.d.)

Law 25: Batter's Innings; Runners

Only a nominated player may bat or act as a runner may do so even though a substitute fielder has previously worked for them. The innings of the first two batters and any new batter on the resumption of play after a call of time shall commence the call of the space. (Law 25: Batter's Innings; Runners, n.d.)

Law 26: Practice on the field

No practice shall be conducted on the pitch at any time of the day during the match. On the day of the game, all forms of exercise are allowed on the outfield, before the start of the play, after the close of space, and during the lunch and tea intervals or between innings provided the umpires are satisfied that which such type of practice, there is no significant deterioration in the condition of the outfield. (Law 26: Practice On The Field, n.d.)

Law 27: The Wicketkeeper

The wicketkeeper is the only fielder who is allowed to wear gloves and extra protection as they are in direct contact with the delivery of the ball. These gloves have specific requirements, such as there shall not be webbing between the fingers except joining the index finger and thumb, where webbing may be inserted as support. The wicketkeeper must remain behind the wickets at the striker's end from the moment the ball comes into play until the bowler delivers the ball. (Law 27: The Wicket-Keeper, n.d.)

Law 28: The Fielder

The fielders, except the wicketkeeper, cannot wear gloves or external leg guards. A fielder may field the ball with any part of their person. However, they will be deemed to have fielded the ball illegally if, while the ball is in, they willfully did. (Law 28: The Fielder, n.d.)

Law 29: The wicket is broken

The wicket is broken when at least one bail is completely removed from the top of the stumps or one or more stumps are removed from the ground. (Law 29: The Wicket Is Broken, n.d.)

Law 30: Batter out of their ground

A batter is considered out of their ground unless some part of the person or the bat is grounded behind the popping crease at the end. However, a batter shall not be out of their ground if, in running or diving towards their environment and beyond and having grounded some part of their person or bat beyond the popping crease. (Law 30: Batter Out Of His/Her Ground, n.d.)

Law 31: Appeals

A batter is dismissed if they are either given out by an umpire on appeal or under any of the laws. Neither umpire shall declare a batter out even though they may be out under the laws unless appealed to by a fielder. (Law 31: Appeal, n.d.)

Law 32: Bowled

The batsman is out bowled if their wicket is put down by a ball delivered by the bowler, not a No ball, even if it first touches the striker's bat or person. (Law 32: Bowled, n.d.)

Law 33: Caught

The striker is caught out of a ball delivered by the bowler, not being a No ball, and touches the batsman's bat without having previously been in contact with any fielder and is subsequently held by a fielder as a fair catch. (Law 33: Caught, n.d.)

Law 34: Hit the ball twice

The batsman is out if they hit the ball twice while the ball is in play, it strikes any part of their person, or is stuck by hither, and before a fielder has touched the ball, the batsman strikes it again with the bat or hand not holding the bat, except the sole purpose of guarding their wicket. (Law 34: Hit The Ball Twice, n.d.)

Law 35: Hit Wicket

The striker is out hit wicket if, after the bowler has entered the delivery stride and while the ball is in play, their wicket is broken by either the striker's bat or person. (Law 35: Hit Wicket, n.d.)

Law 36: Leg Before Wicket

The batsman is out Leg Before Wicket if the bowler delivers a ball, not a No ball, but for the interception, the ball would have hit the wicket. (Law 36: Leg Before Wicket, n.d.)

Law 37: Obstructing the field

Either batter is out, Obstructing the field. If the ball is in play, they willfully attempt to obstruct or distract the fielding side by word or action. A batter shall not be out Obstructing the field if the obstruction or distraction is accidental, or the block is to avoid injury, or in the case of the striker, they make or subsequent strike to guard their awfully. (Law 37: ObstructingThe Field, n.d.)

Law 38: Run out

Either of the batters is run out if at any time the ball is in a play, they are out of their ground, and their wicket is somewhat put down by the action of the fielder even though the No ball has been called. (Law 38: Run Out, n.d.)

Law 39: Stumped

The striker is out stumped if a ball that is delivered is called No ball, and they are out of their ground, and they have not attempted a run when the wicketkeeper somewhat puts down their wicket without the intervention of another fielder. (Law 39: Stumped, n.d.)

Law 40: Timed out

Once a wicket falls, or the batsman retires from the game, the incoming batter must, unless time has been called, be ready to receive the ball or for the other batter to be prepared to receive the next ball within 3 minutes of the dismissal or retirement. (Law 40: Timed Out, n.d.)

Law 41: Unfair play

The captains of both teams are responsible for ensuring that the play is conducted with The Spirit of Cricket. The umpires shall be the sole judges of fair and unfair play. A referee considers any player's action unlawful or unfair. In that case, they shall call and signal the Dead ball, if appropriate, as soon as it becomes clear that the call will not disadvantage the non-offending side and report the matter to the other umpire. (Law 41: Unfair Play, n.d.)

Law 42: Player's conduct

The umpires shall act on any acceptable conduct. There are four levels of offense and the corresponding actions identified by referees. For each level 1 to 4, playing time shall be counted as lost from the call of Time to the call of Play, excluding intervals and suspensions. (Law 42: Player's Conduct, n.d.)