# Eight Baseball/Softball Training Devices

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# Introduction

When my son and then, two years later, my daughter turned ten, they expressed a desire to play their sport in college. I explained what I thought the process would be and the sacrifices they would have to make…tryouts, club teams, practices, lessons, giving up other sports and activities, etc. I also declared on that first day of the journey that academics would be a priority over athletics. They would have to maintain a high level of effort in their classes regardless of the workload of their club and school teams.

My contribution to their quests included playing financier, chauffeur, bullpen catcher, cheerleader, assistant coach, and fan beyond the outfield fence well out of earshot of incompetent coaches. One of the most important roles was that of an "optimally zealous" father. While walking the fine line between guiding and pushing, I not only watched their games with interest, I tried to study the finer points of the two sports and research areas of improvement.

Now that both kids in college and doing well in the classroom and on the field, I wanted to capture a brief description of the training aids that I created along the way. I hope someday the kids will look back at these devices with appreciation and, perhaps, some fondness.

A special thanks is extended to both Kaitlyn Gentert and Greg Riddoch. Kaitlyn was my daughter's first and sixth (and current) pitching coach. Kaitlyn was not only an ace pitcher in college, she is an AP social science teacher at a local high school. As an accomplished professional instructor, she is constantly improving her techniques, drills, and instructions. Kaitlyn has been an outstanding mentor and friend to my daughter. Without Kaitlyn, my daughter would not be fulfilling her dream of playing in college nor would she be the remarkable person that she is.

I first met Greg several years ago when my son first started his club team career. I asked around the baseball and softball communities for a list of hitting instructors and the name at the top of everyone's lists was Greg Riddoch. Greg grew up in the area and played D1 at a nearby university. After being drafted and playing for a few years as a professional, he turned to his true calling in life, teaching others. After coaching in the majors for decades, Greg increased his local instructional practice and my kids were fortunate enough to be included. Both of my children benefited greatly from Greg's advice, motivation, and support. I loved observing his lessons, probably more than my kids. Greg is a very special person who has positively impacted hundreds of young men and women.

# Background

Since both kids are pitchers who also hit so I spent a lot of my time around the two sports thinking about the lifecycle of the batter's swing. Deconstructing the process of the swing facilitated the identification of areas of improvement and guided the development of some of these training aids. For my purposes, I identified five stages of the swing.

- ***Ball Detection*** – The initial phase covers the time and effort the batter is trying to detect the ball. The sooner the batter can pick up and begin tracking the ball, the higher the opportunity for a quality at bat. Conversely, the longer the pitcher can disguise or hide the ball, the effectiveness of the pitch increases.

- ***Pitch Recognition*** – Once the ball is detected, the batter goes through the mental calculations of determining the trajectory of the pitch. Several factors drive this process including the motion of the pitcher, the release of the ball, the spin rate and spin axis of the ball, the velocity and trajectory of the ball during this segment of the pitch.

- ***Swing Decision*** – After the batter sees the early parts of the pitch and extrapolates the trajectory of the ball, she must decide to swing or not. The faster this process can happen, the greater amount of time can be allocated to other phases like Pitch Recognition and Swing Execution.

- ***Swing Initiation*** – Once the batter decides to swing, there is a latency before the swing is actually started. The faster this process can be executed the better for the batter. This stage is one of the least researched and developed phases of the swing.

- ***Swing Execution*** – This is the activity of moving the bat in order to contact the ball at the calculated place and time. By minimizing this duration, the saved time can be allocated to other phases and will result in increased quality at bats.

A diagram of the swing lifecycle is shown below:

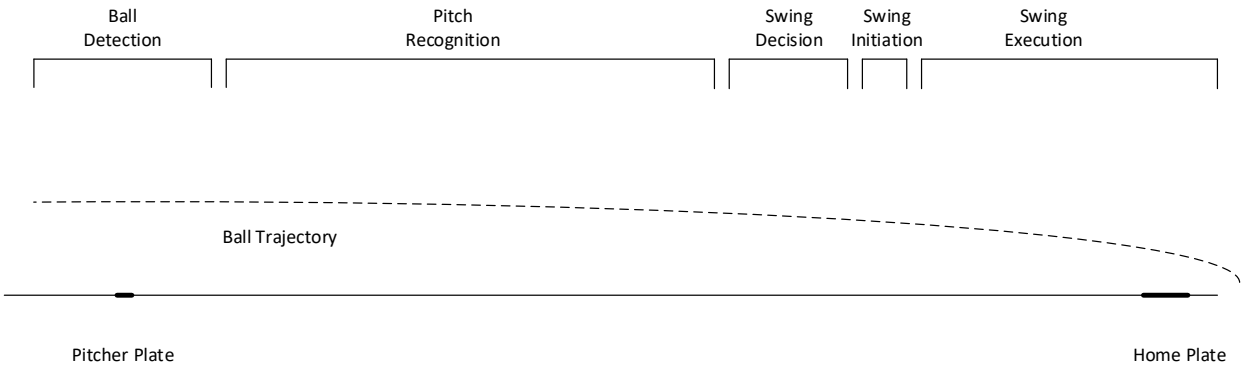


*Figure 1- Stages of the swing lifecycle*

## The Two Towers

There are moments in this journey that I hear a quote or idea that crystalizes general and uncollated thoughts that I have. When these moments do happen, I quickly add the new theory to my life's portfolio. The cornerstone of my pitching philosophy emerged the first time I heard about the three "S"s of pitching…."Spot, Spin, and Speed….in that order". I believe the 3S quote is much more enlightening that the "control and command" statement that I often hear in the baseball domain. While I have always stressed control of the ball over outright velocity, I really embrace the three components of the 3S theory and the priority of them.

The challenge of the 3S approach is providing tools and training aids that provide feedback to the pitcher and instructor regarding spot, spin, and speed as a holistic approach. With a speed-oriented approach, the radar gun provides the feedback desired. Radar guns easy to use, widely available and provide instant measurements. Most users will record top velocity values while the more sophisticated users will only accept measurements when the pitch is in the strike zone.

In a spot-oriented approach, the pitcher is ideally pitching at a target in the strike zone. I have seen several facilities where the target is several feet behind the strike zone which negates the benefit of using a target. Having the pitcher being able to control the pitch vertically and horizontally as the ball passes through the strike zone is critical.

While there is at least one device to measure the spin of the ball, I rarely see this metric in practice. I purchased such a devices and my kids felt the spin rate was too abstract a number. They couldn't really tell the difference of pitches that varied by 8-9% in the spin rate. This device was great a measuring the spin rate but not at providing feedback for incremental improvement.

What I thought my kids needed was a tool that would, at a minimum, give feedback on where the ball passed through the strike zone especially along the vertical axis. This would help the pitcher be able to raise or lower the pitch in the zone to accommodate for different batters and umpires. Ideally, the device could measure the height of the pitch at the onset of the swing execution phase of the lifecycle. This feature would allow the pitcher to work on the "late movement" of the pitch. A high level concept diagram is shown below.

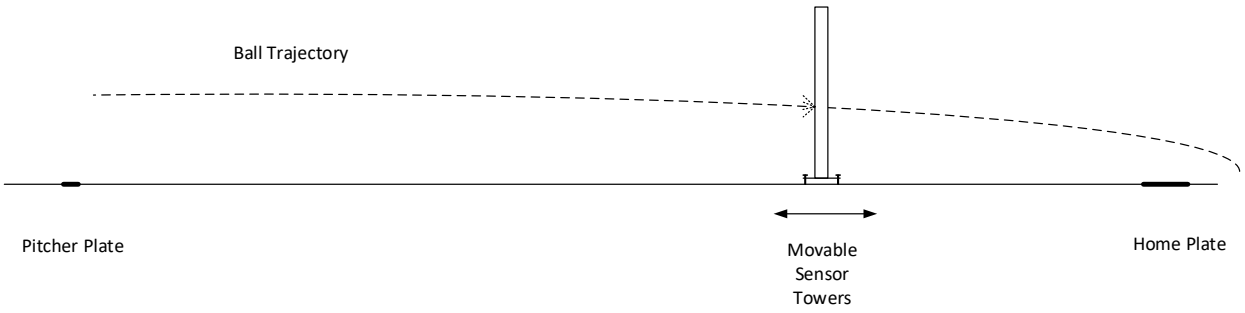


*Figure 2- Moveable sensor tower*

There are several ways to design a device for this purpose. One option is use one or more cameras and write custom image processing software. However, I wanted have feedback to the pitcher at or near the plane being observed and I wanted to keep the architecture as simple as possible. I haven't done circuit design and construction in over 20 years but I really enjoyed the process and wanted to do it again. I decided to use a photo diode that projects a small light beam at a custom circuit board. When the beam is broken by the ball as it pass through the plane, a LED light will turn on for three seconds and then turn off. This photo diode/sensor board will be replicated 20 times with a 2.5 inch spacing. A drawing of "The Two Towers" is shown below.

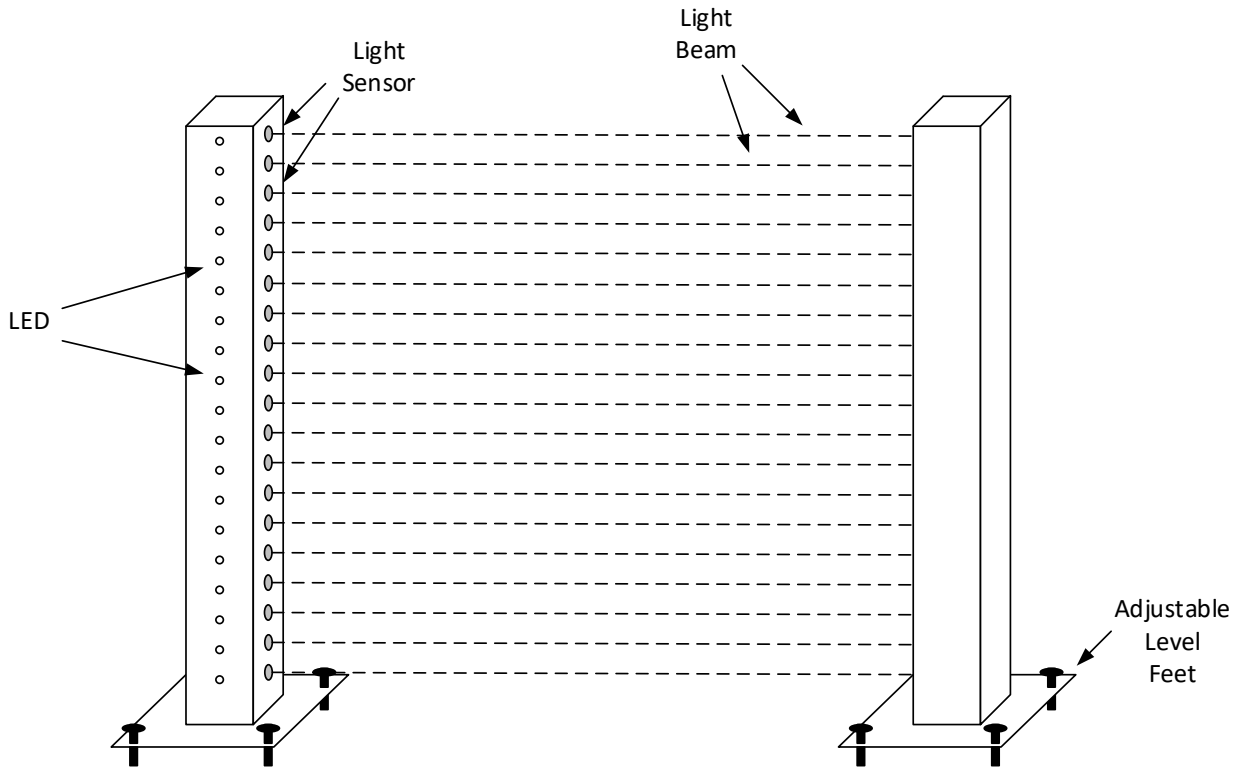


*Figure 3- The Two Towers conceptual drawing*

The project was pretty straightforward and a lot of fun to design and build. The largest deviation from plan was the addition of a calibration LED light to the sensor circuit. During the prototype phase with a breadboard, I realized that the 3 second delay in the sensor LED was making the aiming of the photo diode very difficult. I needed a way to that would indicate when the light beam was aimed properly at the light sensor and without a latency. I added a blue LED that would turn on and stay on when the light beam was correctly centered on the sensor.

The following three pictures show a softball being thrown through the plane. The first picture in the series show the blurred image of the ball to the right of the number 2 on the mat in the background. The second picture in the series shows the ball in the plane (in the center of the mat) and the LED turned on. The final picture shows the ball past the plane while the LED remains on.

*Figure 4- The ball is before the plane. It is to the right of the number 2 on the mat in the background.*

*Figure 5- The ball is in the plane of the towers*

*Figure 6- Ball is past the plane*

A video of The Two Towers can be viewed at:

https://youtu.be/jqrgXhJknlo

# Swing Timer

Over the years, I have witnessed hundreds, if not thousands, of practices, lessons, tryouts, and pre-game warmups. With each drill, I ask two questions…"What's the purpose?" and "Is it effective?" Sometimes I can find an answer to the first one and rarely is an answer offered for the second. Baseball and softball are victims of the past and lead by coaches who blinding propagate the teachings of their last playing days whether that is Little League, high school, or junior college. We simply don't ask the question of "Why?" enough.

For example, I have seen my kids spend hours hitting off a batting T into a net. What's the purpose? Because a coach told them to do so. Is it effective? No way to tell. Besides the "Two Tee" drill that Greg Riddoch showed me years ago, I have not been a fan of "Tee work" without the real time guidance of a qualified instructor. Hitting 200 balls off a single Tee alone in the garage is a sub-optimal use of time and energy. There is no goal, no quality feedback, and no measurement.

The most common measurement with a batting Tee is the ball exit velocity (BEV). The BEV is typically measured with a radar gun behind a net. A batter hits the ball off a TEE into the net and the velocity is recorded. The issue that I observed with this technique is the negative impact it has on the batters swing. I am frequently reminded of the movie "Happy Gilmore" when I see the huge swings these kids make. I believe it's a useless metric unless it is taken with a pitching machine set at game speed or with the device described below.

To help my kids with improve the effectiveness of their swings, I created a tool that would measure the time of the Swing Initiation and Swing Execution phases. By reducing these time periods, the batter is either shortening the swing (a good thing), swinging with greater speed (a good thing) or both (a great thing!). Combining this measurement with the ball exit velocity, the batter may see increment improvement of her swing duration and velocity.

The device operates by having a LED light flash once to inform the batter to load. This is analogous to a pitcher beginning his pitching motion. After a small amount of time to replicate the Pitch Recognition and Swing Decision phases, the LED will flash again and a timer is started. The batter sees the second flash and swings the bat to the ball. The time will stop on impact with the ball and the duration is displayed on the laptop. In order to keep the batters honest and to emulate game conditions, the interval between the two LED flashes is varied by a small, random amount of time. A conceptual drawing of the device is shown below.

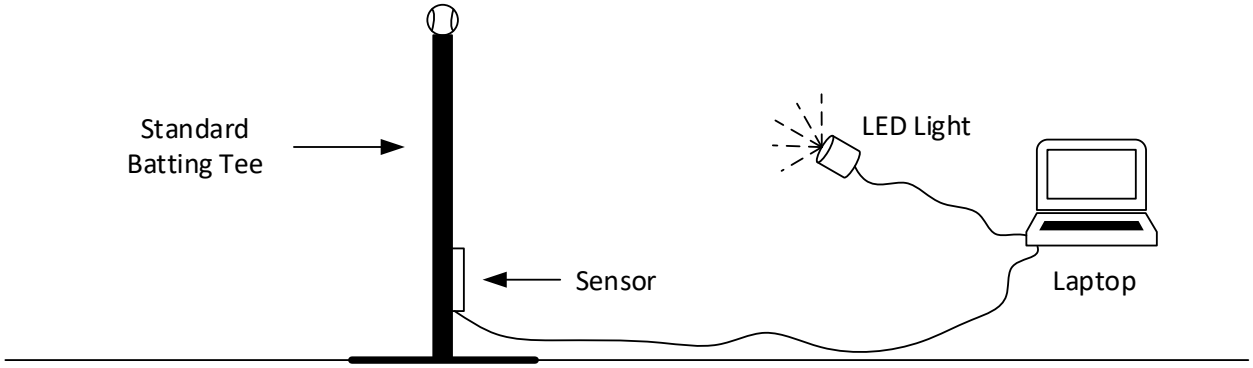


*Figure 7- Major components of the Swing Timer*

The picture below shows the Swing Timer is use. In this version of the device, the LED is located in the sensor box at the base of the batting Tee.

*Figure 8- Swing Timer in action*

## Pitching Launching Block

Softball and baseball should be games of explosions…quick, short, and powerful bursts of energy. I embrace coaches and instructors who have adapted this philosophy and dismiss those who haven't. Kaitlyn, my daughter's pitching coach, is one who preaches and practices this belief.

During the pitching lessons, when Kaitlyn instructs my daughter to explode from the pitcher plate, I tell myself that I should get a track and field starting block. However, since I'm a father of teenagers and I know absolutely nothing, I didn't believe my daughter would use it. One day, Kaitlyn tells my daughter to think of the pitcher plate as a starting block and drive her legs from it. My daughter, being a victim of the youth sports specialization movement, looked at Kaitlyn in bewilderment. She had never seen, let alone used, starting blocks. I asked Kaitlyn if she thought a starting block would be useful and she replied yes but did not know where to begin to find a set.

The challenge was not finding a set of starting blocks (thanks eBay!) but to keep the unit from sliding while in use. Traditional starting blocks are secured to the running track with a pair of large pins. The holes in the block are aligned over holes in the running track and the pins are inserted. To secure the block in the pitching tunnel, I created a simple aluminum bracket that bolted to the starting block and could be placed over the pitcher plate that is attached to a pitching mat. A conceptual drawing of the device is below.

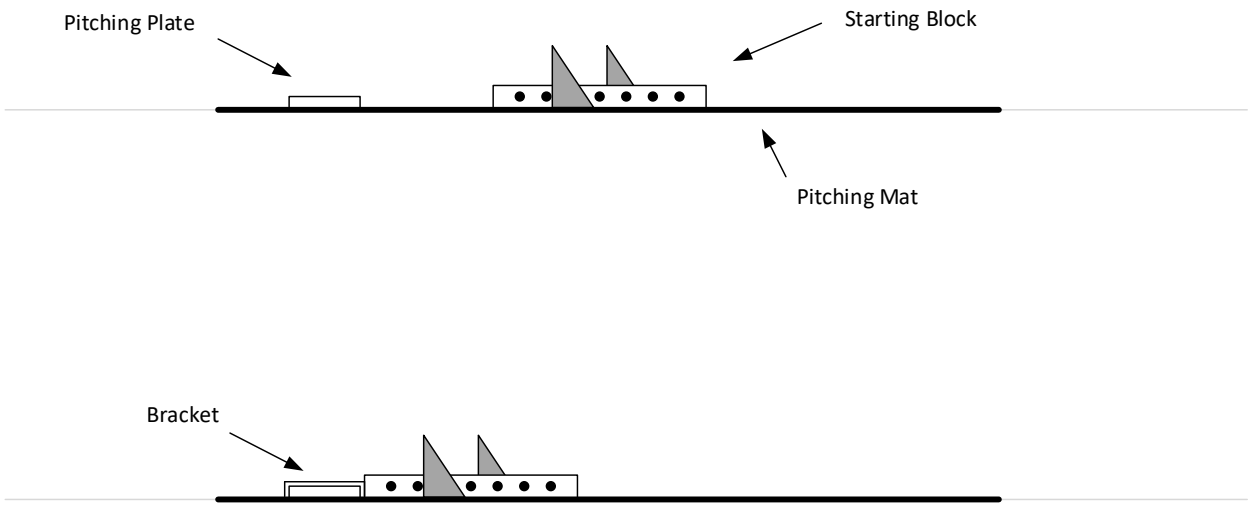


*Figure 9- Conceptual drawing of the Pitching Launching Block*

The launching block was one of the simplest devices I have built and probably the most effective. In fact, my daughter like it so much during Kaitlyn's lessons that she asked for me to build one for her practice area in our basement. A picture of the actual device is show below.

*Figure 10 - Pitching Launching Block ready for use*

## Hitting Platform

A few years ago, Greg Riddoch ask me to build a hitting platform that would re-enforce his core beliefs in hitting. He wanted a platform that would allow the front foot to be secured…he doesn't believe in a large stride but at most a toe tap for timing purposes…and allow the rear foot to easily rotate. Greg also stated that he wanted the platform to be extremely durable and lightweight.

To accommodate different sizes of batters, my design allows the front foot positioned along the X-axis (see the diagram below), the Y-axis, and rotated around the Z-axis. Once positioned the foot can be secured via a snowboard binding. This binding is mounted to the platform with a quick release mechanism so that left handed and right handed batters can be fitted very quickly with the appropriate binding. A disk with ball-bearings is located at the rear of the platform and allows the trailing foot to be easily rotated during the swing motion.

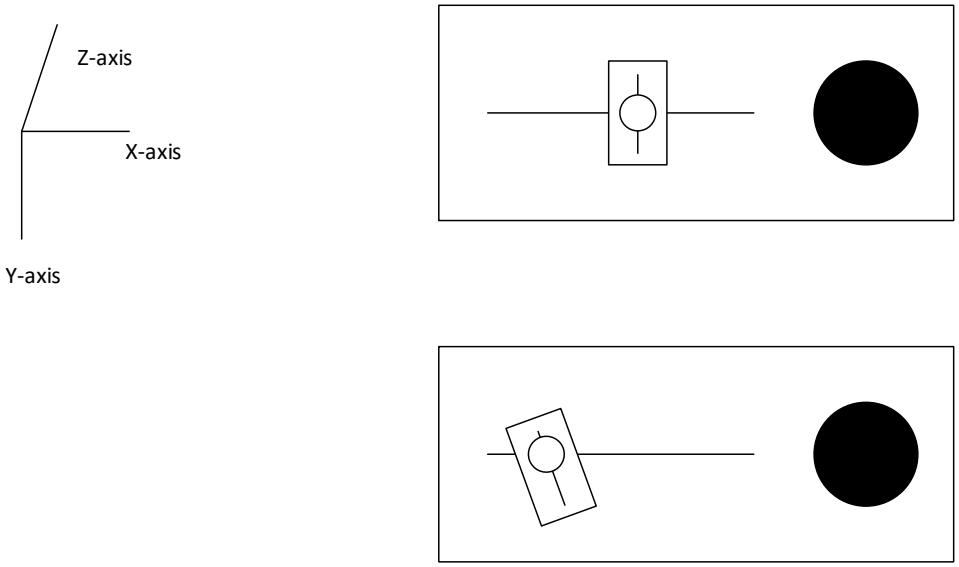


*Figure 11- Conceptual drawing of the platform*

A picture of the actual platform is shown below. It is fitted with a binding that accommodates right handed batters.

*Figure 12- The platform near completion*

## Portable Hitting Platform

The original Hitting Platform has proven to be very beneficial for several of Greg's students. Greg mentioned once the only drawback is that he could not take it to camps that he attends throughout the nation. I decided to build Greg a portal version. The conceptual drawing of this version is show below:

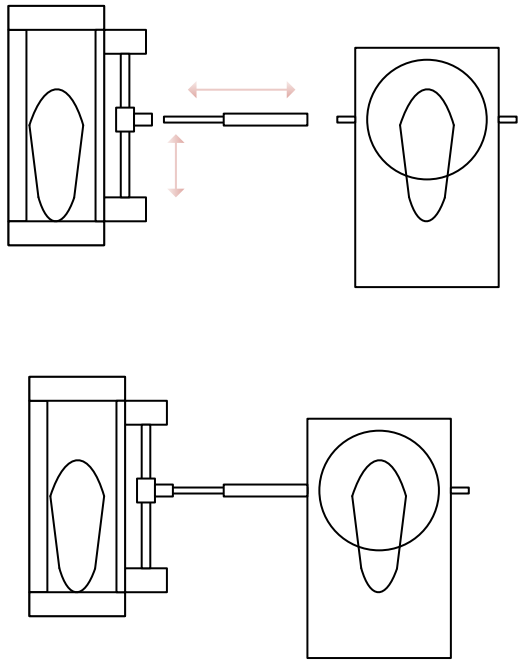

*Figure 13- Conceptual drawing of the portal platform.*

One of the features with this design is that it accommodates both left and right handed batters by rotating the rear foot platform 180 degrees. A picture of the actual device is shown below:

*Figure 14- The actual portal platform.*

## Batter's Belt

After I built the two platforms, Greg asked me to construct a training aid that he has wanted for over 40 years. Greg wanted a device to help his younger students learn to rotate their hips. His idea was to mount a small toy bat on a belt. He would then put a small foam ball on a batting Tee. The student would then rotate their hips in order to "swing" the toy bay to contact the foam ball.

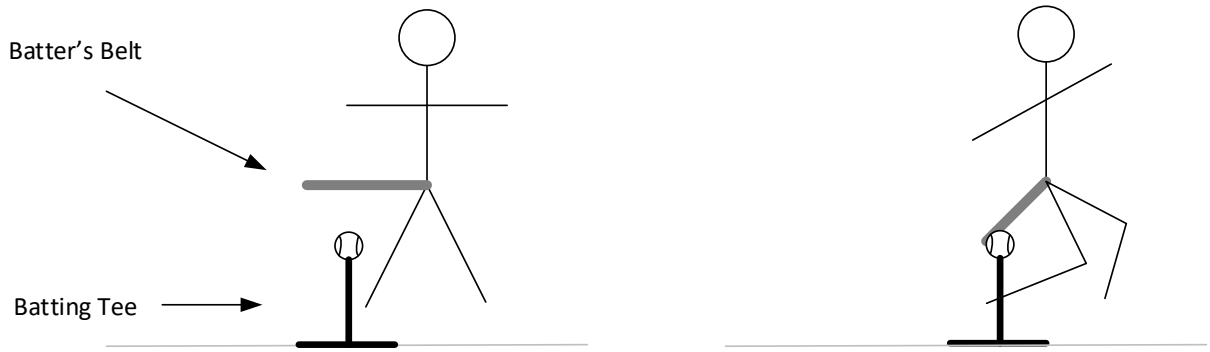


*Figure 15- Conceptual drawing of the Batter's Belt*

A picture of the actual device is shown below.

## Batting Balance Beam

When a player begins their first lessons with Greg, I would often hear Greg say to stay back and not lunge at the ball. To assist a friend's daughter who kept lunging at the pitch, I searched online for drills or training aids. The closest tool was a batter's beam which assisted with keeping the feet in a line with the pitcher. However, I could not find a device to help with the fore and aft balance during the swing.

I created the Batting Balance Beam unsolicited and gave it to Greg as my very first training aid. The idea was to be able to move one of the supports along the beam so it could act as a fulcrum. If the batter lunged or moved her weight too far forward, the beam will rotate around the fulcrum and tilt forward in an unnerving but safe way. I was thrilled that Greg accepted the aid and it is still in use in his facility. A diagram of the beam is shown below.

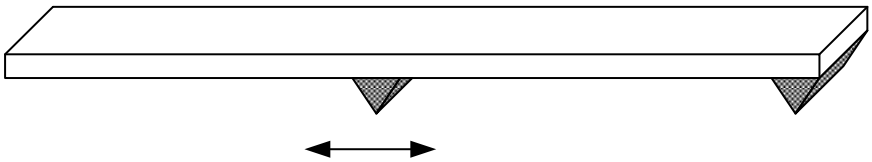

*Figure 16- Conceptual drawing of the beam*

# Moveable Pitching Mound

One of the largest challenges a young baseball pitcher experiences is the transition from flat ground to a pitching mound. In systems engineering, the sooner an entity reaches the new state, the shorter the duration of the transitional period. To help my son become comfortable and effective with the pitching mound as soon as possible, I built a mound for our basement that had two unique features.

The mound is 40” wide and 123 ½” inches long with regulation height and slope. In order to relocate the mound from my shop to our basement, I designed two separate pieces that can be bolted together. Each piece can be carried by one or two people.

The other key feature is the step down casters located on the four corners of the assembled unit. These casters allow the mound to be elevated and easily wheeled around the basement. The mound can be seen in the following pictures.

*Figure 17- Assembled pitching mound*

*Figure 18- Disassembled pieces of the mound*