



## HOW PROTECT THE PLATE USED HITTRAX CATCHING MODULE TO BETTER UNDERSTAND POP TIME

Based in the Boston area, Protect the Plate is a year-round player development program specifically designed for fastpitch catchers. Over the past year, we have been testing and analyzing our high school catchers using the catching module of HitTrax. In doing so, we have had two primary goals in mind: 1) to better understand the relationship between the variables of exchange time, throwing velocity, and pop time; 2) to track athletes' progress over time to identify areas of improvement and growth.

Here is a chart indicating how many athletes were tested, further broken down by year of graduation:

GRAD YEAR	SEP 2019	NOV 2019	MAR 2020	OCT 2020
2020	2	0	2	0
2021	1	3	3	1
2022	6	6	8	8
2023	4	4	4	4
2024	0	0	0	7
2025	0	0	0	1
<b>Total</b>	<b>13</b>	<b>13</b>	<b>17</b>	<b>21</b>

During each evaluation, the following was captured and recorded :

1. Athletes were given 4 attempts to perform their maximum overhand velocity throw;
2. Athletes were given 5 attempts to perform a throw down out of their squat from their feet;
3. Athletes were given 5 attempts to perform a throw down out of their squat from their knees.

All throw downs were performed off of a pitching machine in order to simulate a live pitch. The machine was set to between 54-58 mph depending on the experience level of the athlete.

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With the help of Anthony Shattell, we generated individual player reports in order to digest the data more easily. Let's break down the key components of the player report:

**EXCHANGE:**

Measured by HitTrax, exchange time is reported as the amount of time from initial contact with the catcher's mitt to the catcher's release of the ball.

**THROW VELO:**

Measured by HitTrax, throwing velocity is reported as the instantaneous velocity out of the catcher's hand captured by radar.

**POP TIME:**

Measured by HitTrax, pop time is reported as the amount of time from contact with the catcher's mitt to second base.

**THROW TIME:**

Throw time is calculated by subtracting exchange time from pop time.

**% OF MAX OH VELO:**

Percent of maximum overhand velocity is calculated by dividing the athlete's throwing velocity out of the squat by their maximum overhand velocity from the same evaluation day. This value tells us how much of a player's maximum throwing velocity capability is "lost" when throwing out of the squat.

**TYPE:**

Type indicates if the throw was made out of the squat from the athlete's feet or knees.

Exchange	Throw Velo	Pop Time	Throw Time	% of Max OH Velo	Type
0.71	53.1	1.97	1.26	94.8%	
0.82	55.9	2.04	1.22	98.2%	Feet
0.76	55.4	1.94	1.18	97.4%	Feet
0.78	54.1	2.00	1.22	95.1%	Feet
0.73	54.1	1.96	1.23	95.1%	Feet
0.70	54.7	1.88	1.18	96.1%	Feet
0.61	54.2	1.87	1.26	95.3%	Knee
0.60	54.1	1.80	1.20	95.1%	Knee
0.60	54.1	1.82	1.22	95.1%	Knee
0.60	53.3	1.84	1.24	93.7%	Knee
0.58	53.2	1.83	1.25	93.5%	Knee
0.70	55.3	1.90	1.20	98.8%	Feet
0.64	55.6	1.85	1.21	99.3%	Feet
0.71	52.5	2.02	1.31	93.8%	Feet
0.72	52.5	2.00	1.28	93.8%	Feet
0.68	52.2	1.93	1.25	93.2%	Feet
0.82	52.6	2.07	1.25	93.9%	Knee
0.69	52.3	2.01	1.32	93.4%	Knee
0.73	53.1	2.02	1.29	94.8%	Knee
0.70	51.6	2.03	1.33	92.1%	Knee
0.72	53.7	1.99	1.27	95.9%	Knee
0.72	53.7	1.92	1.20	98.7%	Feet
0.80	51.1	2.09	1.29	93.9%	Feet
0.83	50.2	2.14	1.31	92.3%	Feet
0.72	50.7	2.01	1.29	93.2%	Knee
0.74	50.0	2.05	1.31	91.9%	Knee
0.79	49.8	2.13	1.34	91.5%	Knee

The red color indicates that the number is better in comparison to the athlete's entire body of work, whereas the blue color indicates that the number is worse in comparison to the athlete's entire body of work. The shade of color indicates the intensity level.

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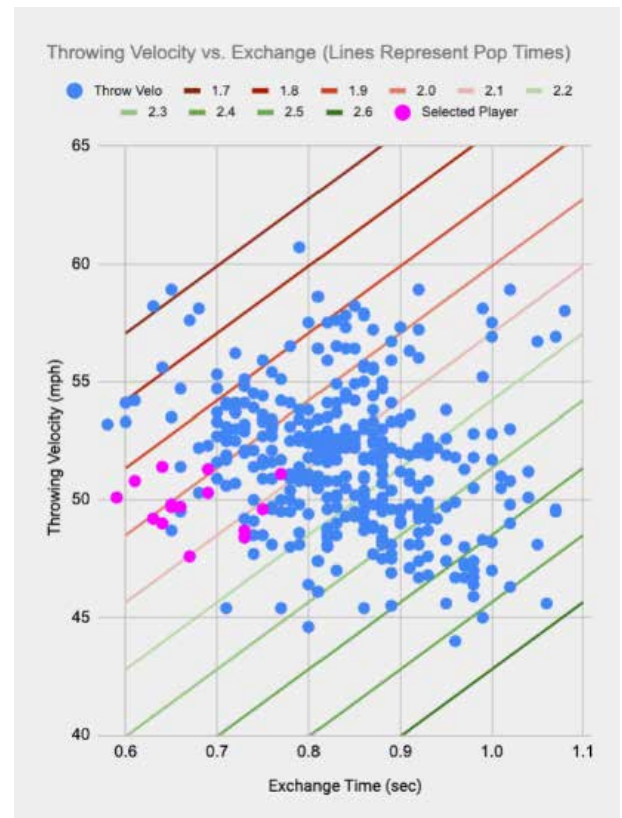
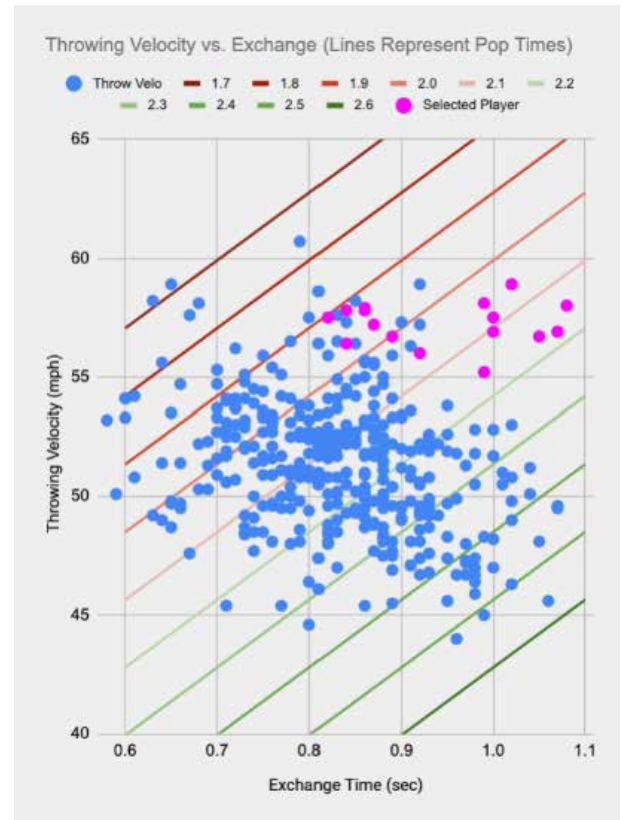
Generally speaking, and supported by this data, driving down exchange time and driving up throwing velocity will drive down pop time. In other words, if a catcher gets rid of the ball quickly at a high velocity, there is a greater chance that the ball will beat the runner to second base. However, we wanted to better understand how the variables interacted with each other, so next, Shattell and I generated a number of graphs to visualize these relationships.

In plotting exchange time on the x-axis and throwing velocity on the y-axis, we can see where each athlete resides relative to her peers on both of these metrics. Since these two metrics work together to influence pop time, we can then overlay pop time "regions" in the form of diagonal lines on the graph. In doing so, we can now see what exchange time and throwing velocity combinations are necessary to produce a specific pop time. Let's take a look at the data from two athletes and compare them side-by-side.

In looking at athlete's data on the top, the pink dots indicate that this athlete has a high throwing velocity out of the squat (average = 57.2 mph) in comparison to her peers, but she has a slower exchange time (average = 0.94 sec). Overall, her average pop time is 2.07 seconds, but she has shown that she is capable of an exchange time between 0.81-0.85. My focus with this athlete during training is to drive down her exchange time while maintaining her current throwing velocity out of the squat. If she is able to hold a more consistent exchange time of 0.80-0.82, her pop time would drop significantly to 1.9 seconds.

In contrast, the data on the bottom shows that this athlete has an average exchange time of 0.67, which is one of the best that we have captured, but she is barely above 50 mph out of the squat. Her average pop time is 2.01 seconds, but my focus with this athlete is to drive up her throwing velocity, which involves coaching her mechanics, patterns and overall strength.

While both of these athletes post comparable pop times, these graphs allow us to gain a better understanding of what is happening with the individual. In general, if an athlete is far from having an elite exchange time (0.65-0.75), a greater emphasis should be put on decreasing it during training in order to decrease overall pop time - similar to the athlete on the left. Additionally, throwing velocity is important, but improving velocity is a more complicated variable that takes a longer time to improve.



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Using the data from HitTrax, we analyzed the relationship between exchange time and percent of maximum overhand velocity. A catcher is going to naturally lose some velocity when they throw out of their squat as compared to their maximum overhand velocity. However, the following questions arise: How much velocity can she afford to lose? Is she maximizing all of her potential power out of the squat? If not, at what point, is she losing some power as she works out of it? Does her exchange time allow her to throw the ball at her maximum velocity out of the squat?

Ideally, we want a catcher to exchange the ball at a fast clip while maintaining a high percentage of their maximum velocity. In looking at the graph below, this athlete has accomplished just that. Over the past year, she has improved her exchange time from an average of 0.86 seconds in September 2019 to 0.76 seconds in October 2020 while bettering her percentage of maximum velocity from 92.2% in September 2019 to 93.7% in October 2020. How does this impact her overall pop time? Ultimately, this athlete's average pop time has gone from 2.2 seconds to 2.02 seconds in the last year.

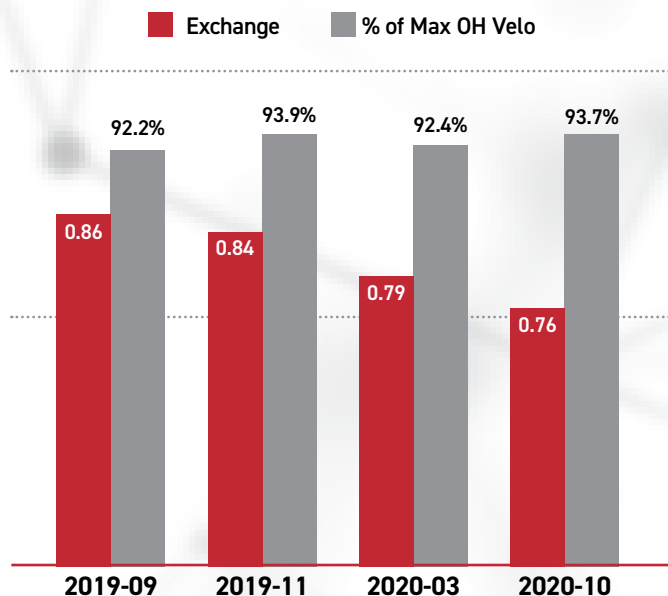
Making a throw out of the squat from one's knees is a popular tactic used in the game of softball because of quick runners and short base paths. Therefore, it was intentional to record whether athletes were throwing from their feet or knees in order to compare the data from each method. Let's take a look at the data from two athletes, and compare them side-by-side:

In looking at the data from the athlete on the left, her pop time when throwing from her knees is 0.1 seconds slower than when she throws from her feet. In looking closer, her exchange time is about the same regardless of method. However, her throw time is significantly slower from her knees, which means that this athlete is losing velocity when she opts for that method. The data and video gathered from HitTrax allows us to look deeper into where, when and why that velocity is being lost when this athlete chooses to throw from her knees.

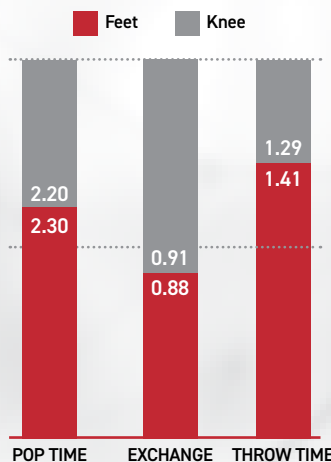
Conversely, in looking at the data from the athlete on the right, her exchange and pop times are about the same regardless of method. While there is certainly room for improvement in driving all of these numbers down, this is a positive indication. With this knowledge, an athlete can feel confident in both methods, and ultimately, allow the pitch to dictate what method she employs in a game.

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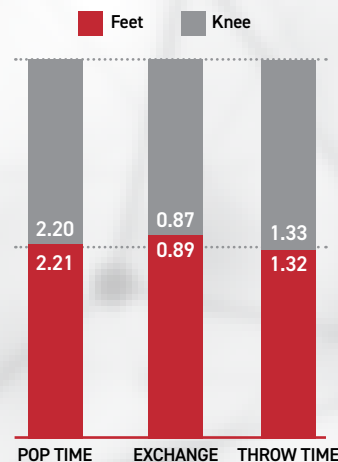
### AVERAGE EXCHANGE & % MAX OH VELO BY DATE



### TIME COMPARISON



### TIME COMPARISON



With the data captured from HitTrax as well as the help of Shattell, we learned a tremendous amount about how the variables of exchange time, throwing velocity and pop time interact with each other. Also, tracking the data and progress of our athletes over the last year has allowed us to design training sessions that are specific to an individual's needs.

**So, what are the implications thus far? Here is what we have learned:**

### **DATA IS ABSOLUTELY CRITICAL.**

It is critical for both athletes and coaches alike. For athletes, digestible and concrete feedback is how they tweak, grow, and improve their craft. The data from HitTrax is the catalyst for identifying nuanced strengths and areas of improvement. For coaches, data keeps us accountable. It allows us to dive deep, to ask questions, and to ultimately, raise our level of instruction.

### **DATA IS FUN.**

When we initially began to use the technology, we did so with two primary objectives, but over the past year, we have uncovered as many questions as we have answered. It has also been fun to watch athletes interact with the system. This generation of athletes has grown up with technology, and this platform allows us to meet them in a place of comfort. As coaches, we want athletes to take ownership of their development and of their process. HitTrax allows them to because while it is fun, it is also tangible and digestible.

### **THERE IS A LOT MORE TO POP TIME THAN A STOPWATCH.**

Not only is the human eye unreliable, but a single number, such as pop time, does not tell the entire story. It is really easy to get caught up into a good vs. bad pop time, and there are many suggested ranges out there for high school athletes. Furthermore, not all catchers have the stereotypical arm strength expected of the position, but does that mean they are not worthy of suiting up? Absolutely not.

Instead, a system as comprehensive as HitTrax allows us to dive into catchers' strengths and weaknesses in order to look at the entire picture: can they make up for their lack of velocity in their exchange time? Are they maximizing their velocity out of the squat? Are they better from their feet or their knees? As the data and graphs suggest, there are many ways to be successful in throwing out runners. It is important for athletes to know where they fit amongst their peers, but it is equally critical for them to feel confident in their skill set and to see improvement over time.

In conclusion, HitTrax is a tremendous tool for coaches and athletes to understand and elevate the game for catchers. By taking all of the data that HitTrax provides, coaches can create an individualized training plan that will allow for each catcher to be successful based on her strengths and limitations. Moving forward, we will continue to collect, learn and dive into the data, and the catchers of Protect the Plate are excited to be on the forefront of this movement!



*This article was written by **Johanna Clair**, the founder/owner of Protect the Plate. You can find PTP on Instagram and Twitter (@ptp\_softball). Anthony Shattell can also be found on Twitter (@soxmoneyball).*

