9364X

2018 MAKE IT REAL CAD ENGINEERING CHALLENGE

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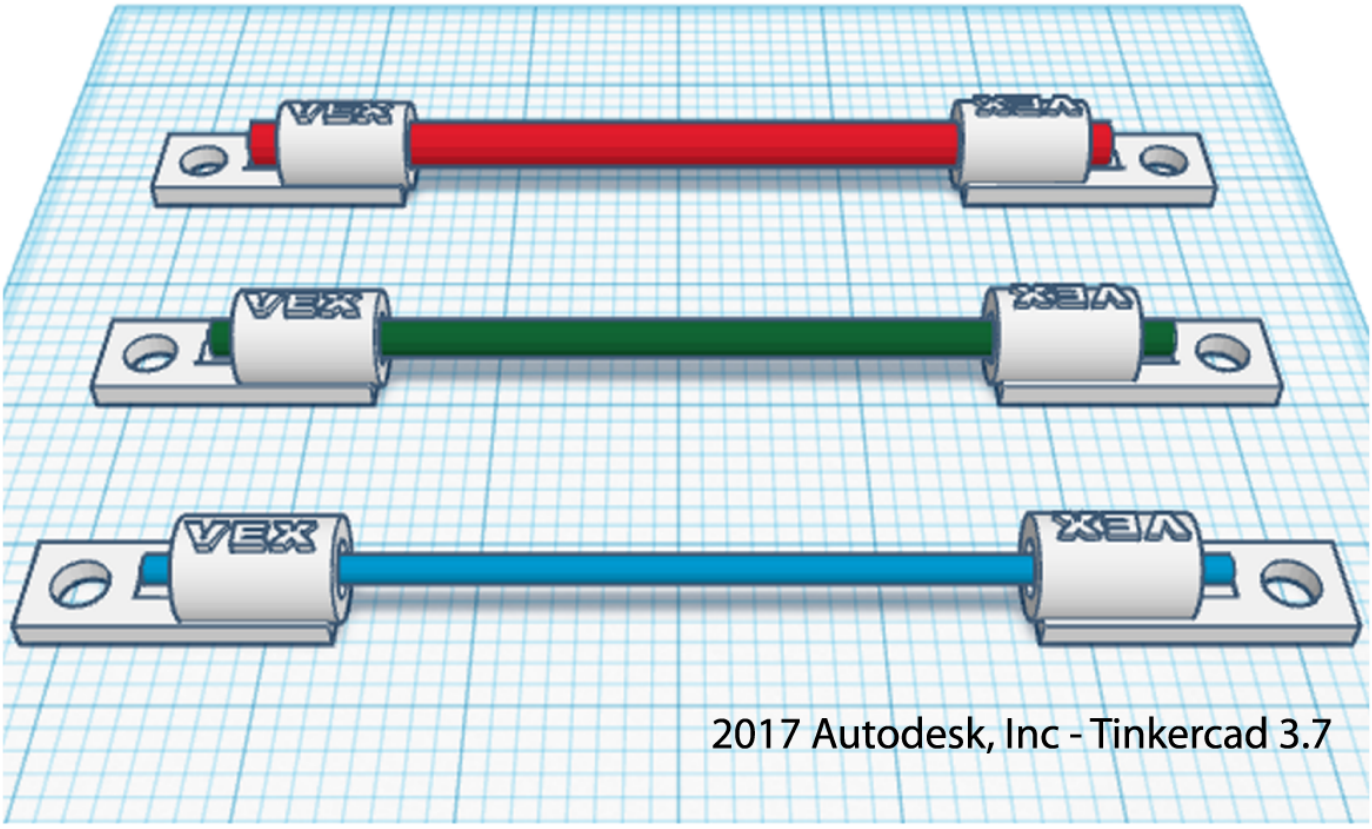
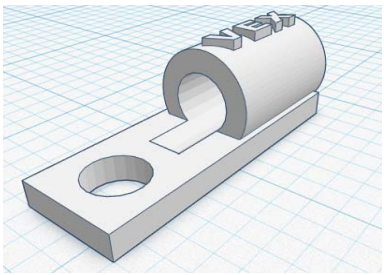
BRENTWOOD ACADEMY (BRENTWOOD, TN)

MIDDLE SCHOOL

VEX ADJUSTABLE TENSION TETHER





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Middle School Division

VEX ADJUSTABLE TENSION TETHER

THE CHALLENGE

One major challenge that many teams grapple with is how to add torque or speed to a robot mechanism. The simplest and most common way is to grab a handful of rubber bands and strap them onto the robot. After three years of using this same method, I thought there had to be a way to not only make this task easier to complete, but to make it reliable and able to last for long periods of time. Rubber bands are a loop of stretchy rubber that pulls things together. They have always been a part of VEX Robotics and will continue to be used until someone invents a better idea. My robotics team buys a dozen large bags of rubber bands each year to last all season because the bands break, stretch out, and become unreliable during competition over shorts periods of time. This is the reason I set out to find a stronger, faster, and more reliable way to solve this problem that has affected VEX robotics teams for a long time.

THE SOLUTION

The **VEX Adjustable Tension Tether ["ATT"]** is a simple system that quickly and efficiently replaces rubber bands and provides the torque or speed that, prior to now, only rubber bands were able to accomplish. This system is a combination of shock cords with varying tension, a washer, and a 3D-printed fastener that allows the shock cord to be attached to the robot in a variety of different ways. The **ATT** is made to be more durable, more reliable, and last longer than standard rubber bands.

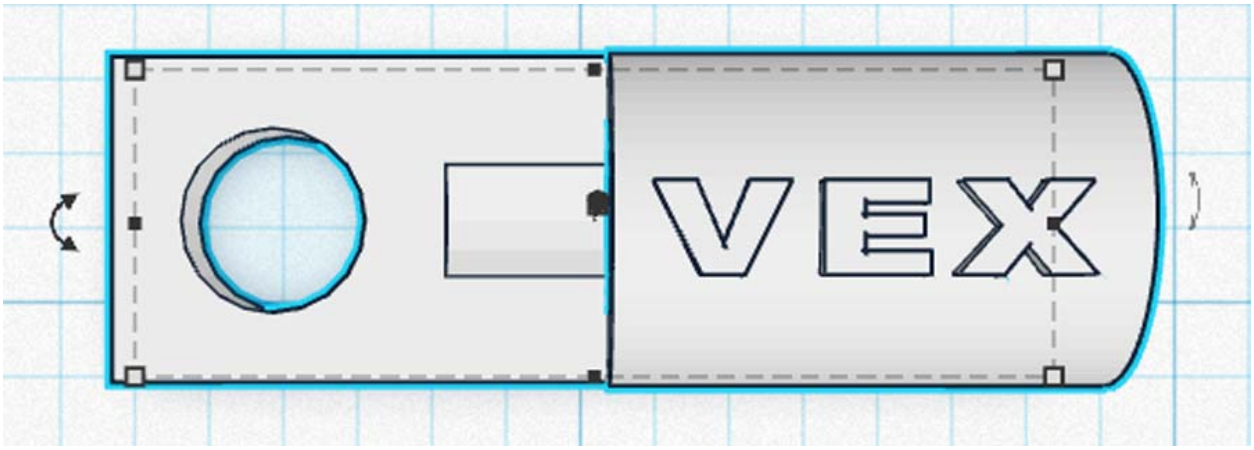
This system is designed to be mounted on the robot wherever the designer wants, and once it is attached, it should not need to be replaced. The fastener part has one longer hollow cylinder for the shock cord and a shorter, thinner hole for mounting it with a screw or onto a standoff. This part is small and space efficient because it holds the shock cord without needing another part to do the job. The **ATT** is the simplest and most efficient way to create tension and enhance the performance of the robot mechanisms.

SOFTWARE

I chose to use Tinkercad to create the **VEX Adjustable Tension Tether**. I used version 2017 Autodesk, Inc. - Tinkercad 3.7. This is my second year competing in this challenge and last year I used Fusion 360. I started last year without any knowledge about CAD and learned all I could to make the VEX License Plate Holster.

When I started thinking about this year's challenge, I had a choice to use Fusion 360 to create a simple part, or try the simpler Tinkercad to create something more complex. After brainstorming an idea that I thought would be able to help my team and the rest of the VEX Robotics community, I went to the drawing board and sketched the **ATT** on graph paper so that my measurements would be accurate.
Then I chose to design the **VEX Adjustable Tension Tether** in Tinkercad. Within Tinkercad, I first created the base plate with a hole in it for mounting. Then using a hollow cylinder, I created the space for the shock cord to be attached. Lastly, I placed the letters V-E-X on top and finalized the **ATT**.

The main thing I learned from my experience last year is to precisely measure all of the dimensions. Previously, I made my 3D prototype and three or four of the measurements were off which prevented the license plates from fitting properly. This year I took this knowledge into account and made the **ATT** exactly how it had been designed and measured on paper. Even though I had done it before, it still amazes me how I can manipulate objects in software, and then 3D print an object that transforms from the screen to a physical object.

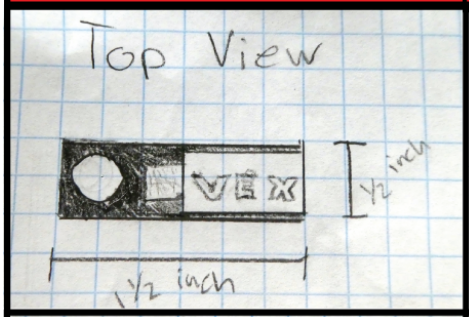
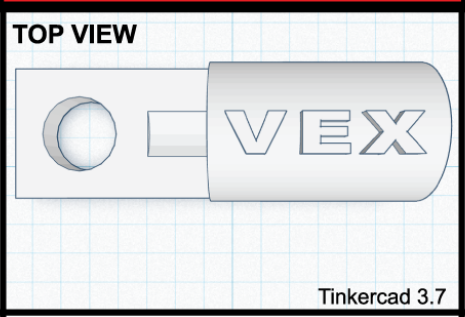
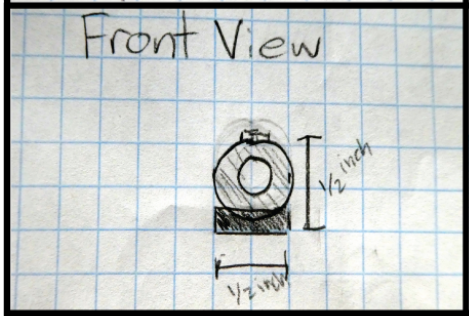
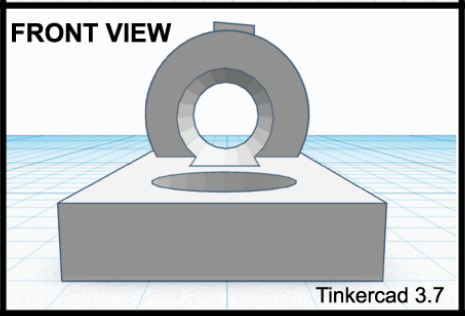
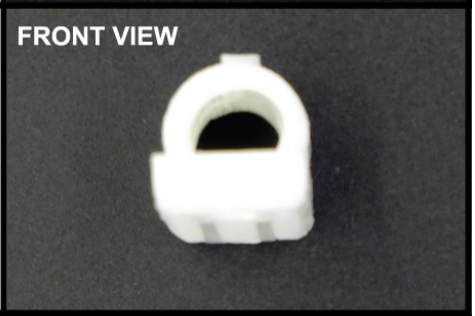
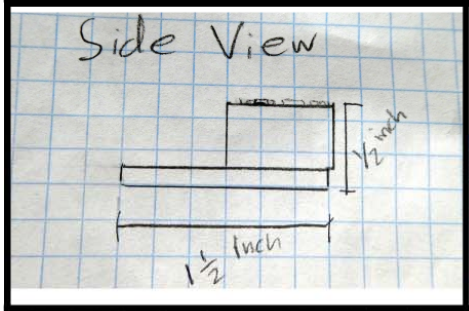
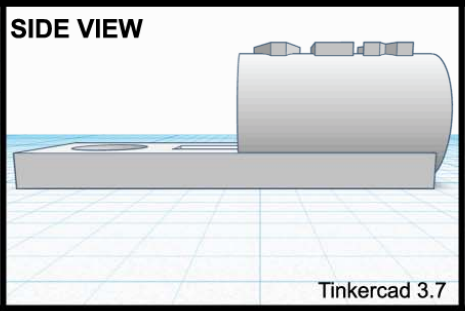
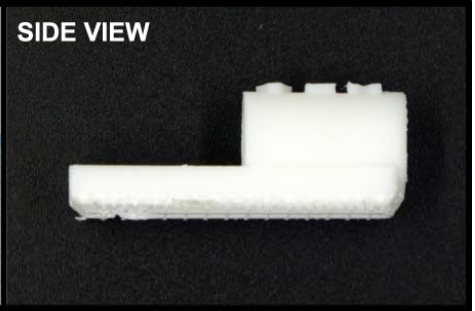
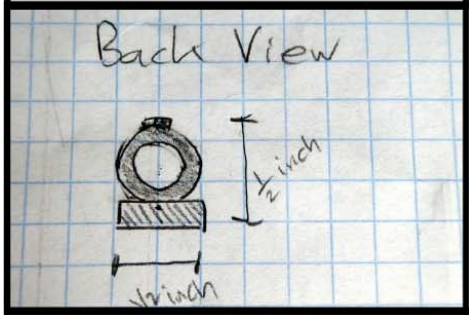
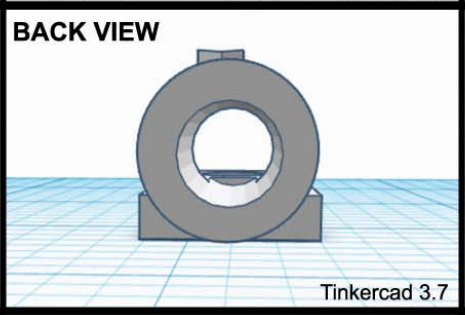
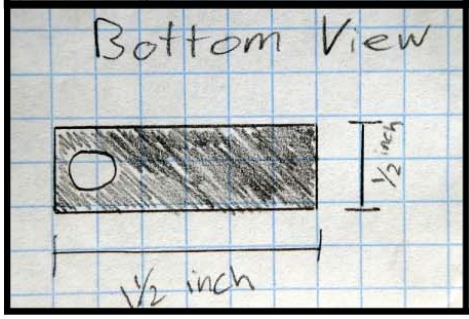
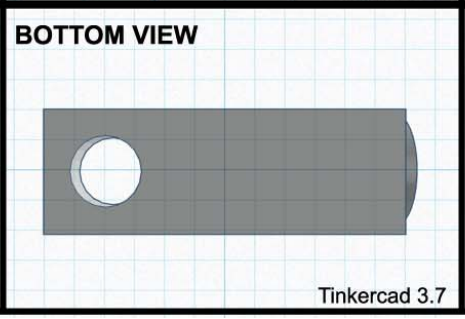


REFLECTION

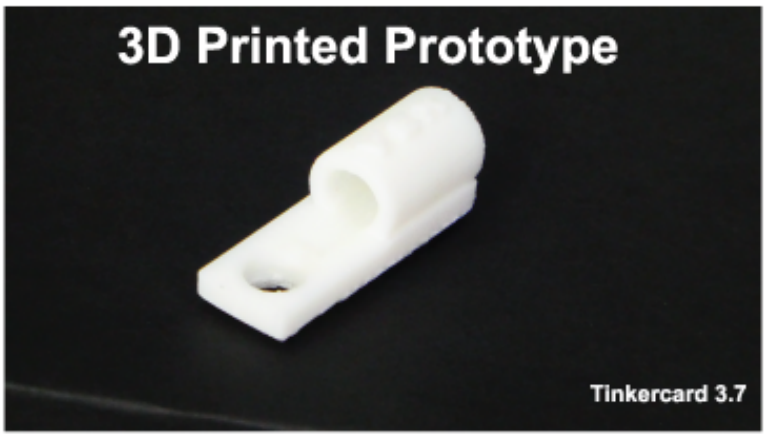
I hope that the **VEX Adjustable Tension Tether** will revolutionize the enhancement of speed and torque robot functions by benefiting the entire VEX community. This challenge has augmented my ability to use CAD and shown me that there is no limit to what I can design. Over the last two years I have learned the importance of taking accurate measurements and knowing the dimensions of my designs. Also, it is helpful to print the part and examine it so that I know exactly what it can accomplish. By printing the **ATT**, I learned that it could be attached in more ways than could be seen on the computer. A second lesson that I learned was when I moved from Fusion 360 to Tinkercad – sometimes simpler is better. This can be applied to many things, such as a mechanism on a robot, a CAD project, CAD software, or strategy in a competition. After applying these lessons to my project, I was able to create a 3D printed model of the **ATT**.

I plan to use this software to help me with many projects in the future. One main project would be to improve my Engineering Notebook by designing a replica of each robot mechanism rather than sketching a few unclear drawings. Refining the Engineering Notebook is an excellent way to win an award such as the Judges Award, the Build Award, the Design Award, and the Excellence Award.

I see benefits to using CAD in my classwork. For instance, I have recently been assigned a "dream home" project and can use Tinkercad to complete the project. Learning to use CAD proficiently will also be helpful in VEX U, because I will be able to 3D print parts as necessary. In the future, I want to be an engineer and mastering complex CAD concepts will put me miles ahead when learning to make more complicated prototypes. Ultimately, I hope that the **VEX Adjustable Tension Tether** will provide a beneficial solution that will prove to be an asset to all of the VEX community as a means to change the way robot mechanisms can be enhanced for the better.

SKETCHES	TINKERCAD DESIGNS	3D PRINTED PROTOTYPE
		
		
		
		
		

VEX Adjustable Tension Tether Components



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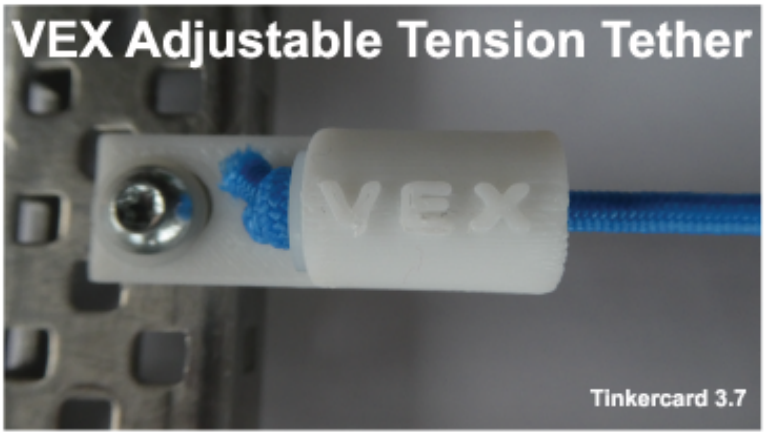
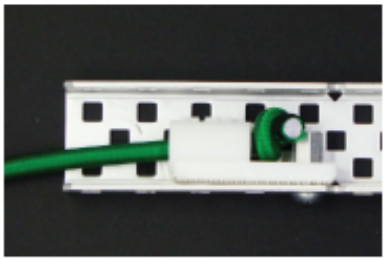
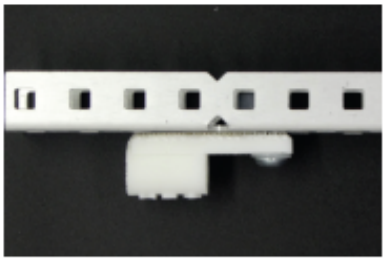
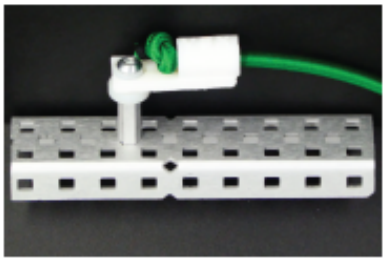
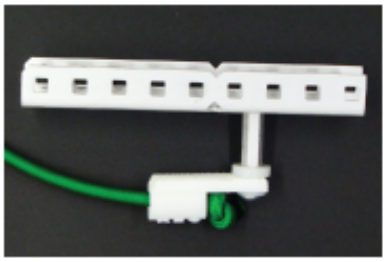
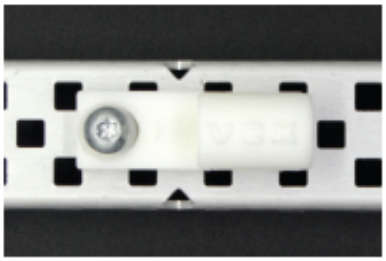
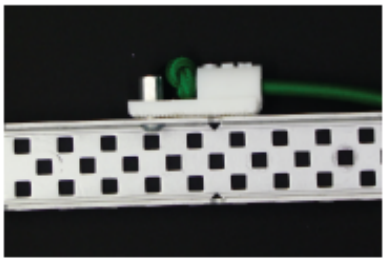
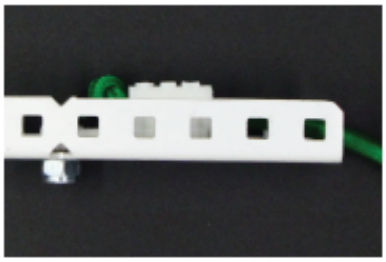
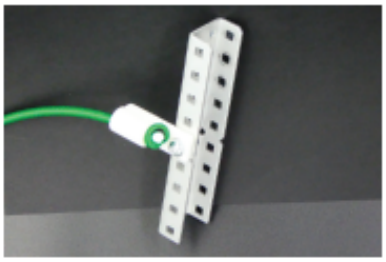
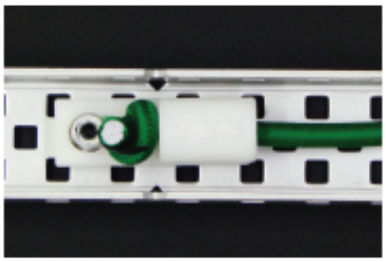
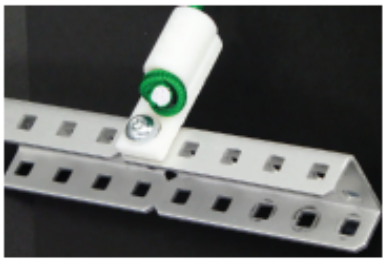
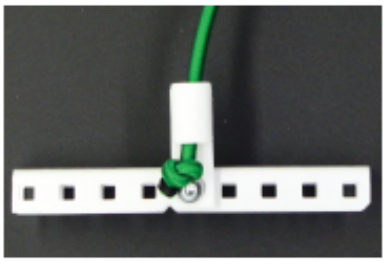


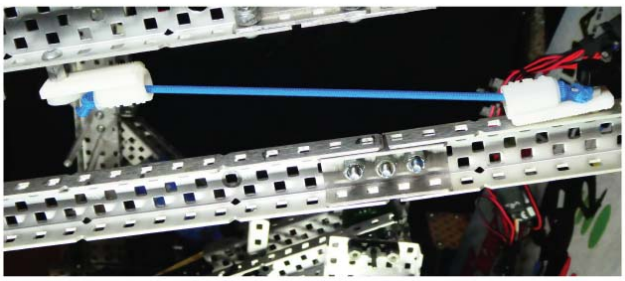
VEX Adjustable Tension Tether Mounting Options

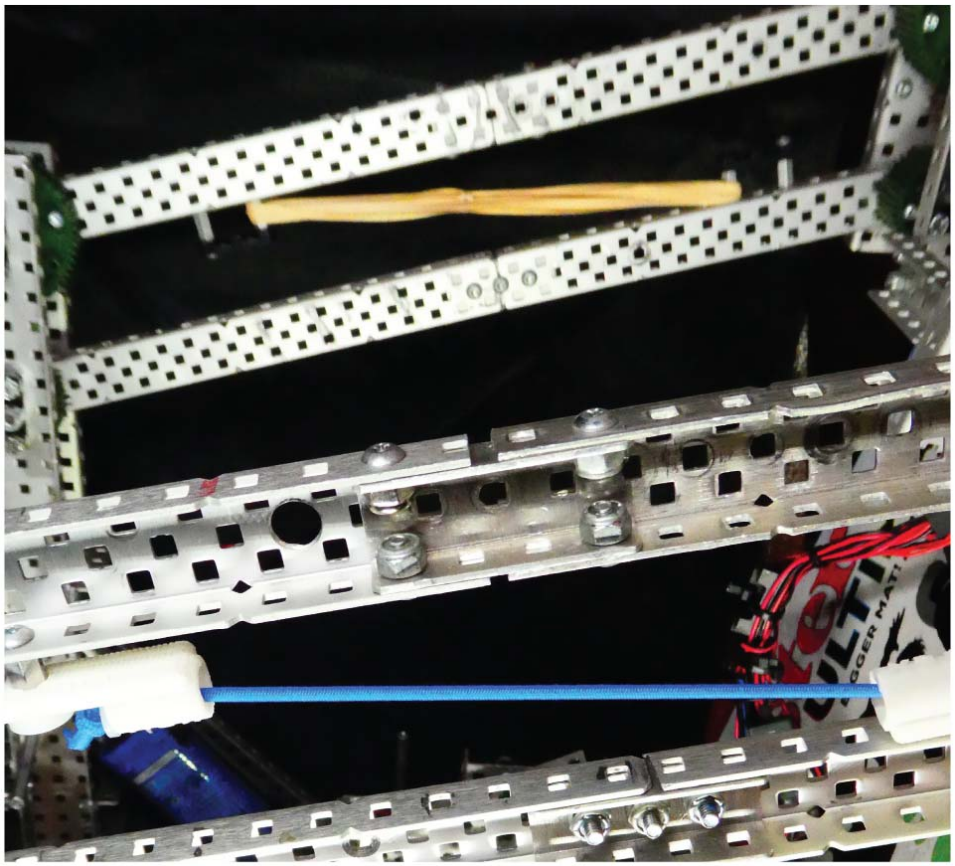













VEX Adjustable Tension Tether Comparison

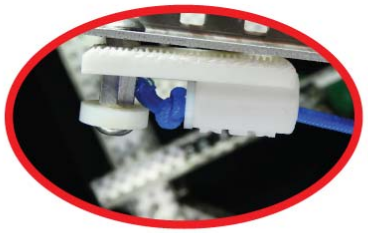
Standard Rubber Band Attachment

VEX Adjustable Tension Tether





Close-up of Rubber Band Mounting



Close-up of VEX Adjustable Tension Tether