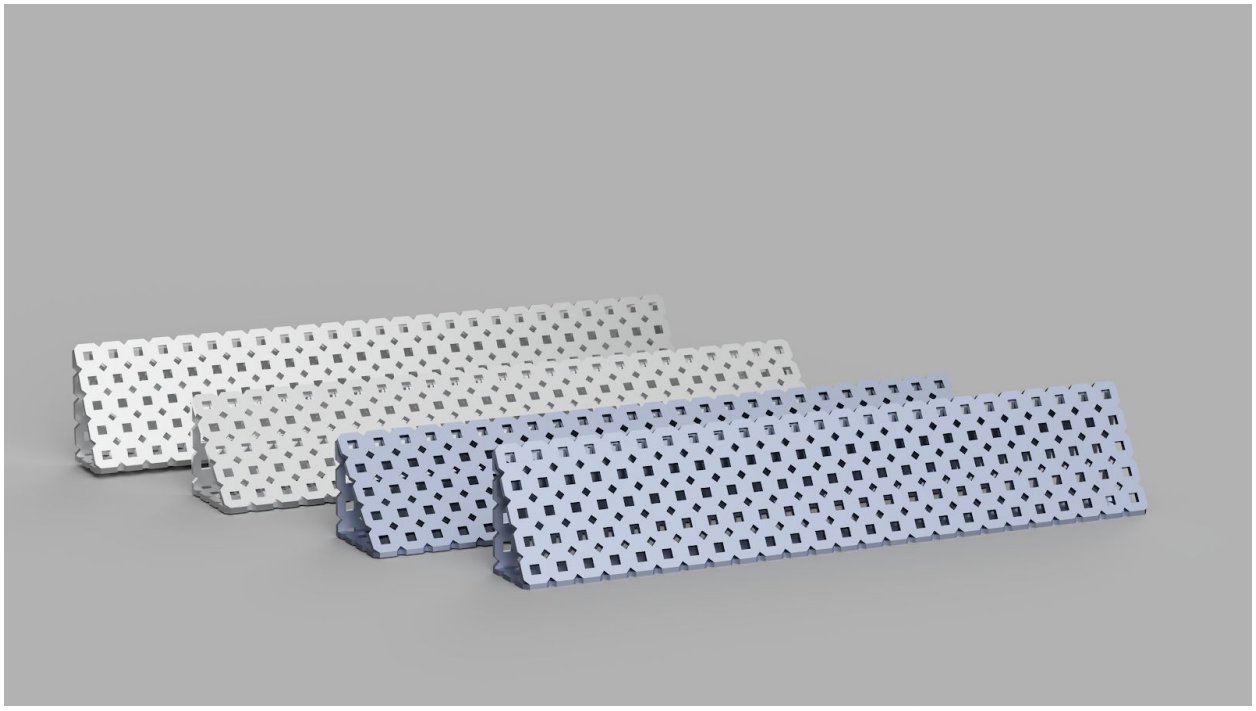


Skirts

Team 11570
South Side Robotics

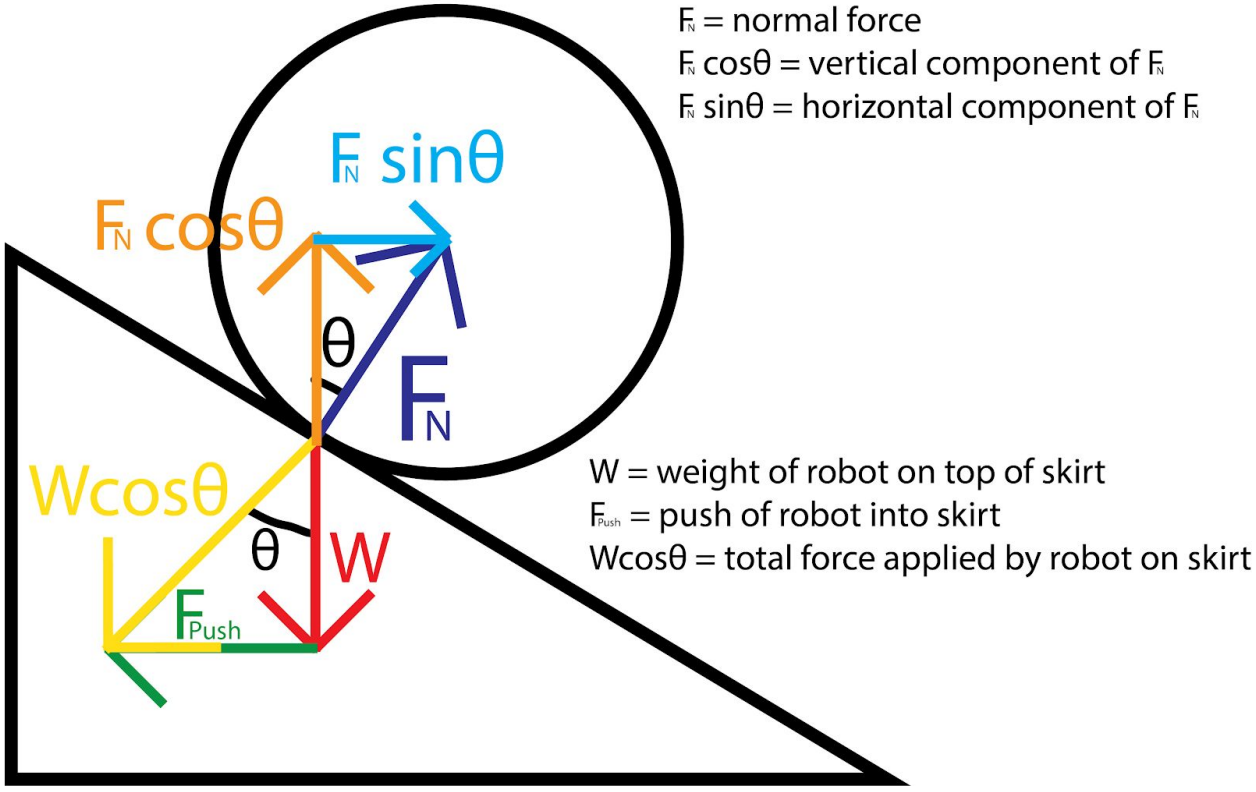
What Are Skirts?

Skirts are commonly found on cars and they are very useful in many ways. They first appeared attached to Brad Keselowski's NASCAR car. The side skirts helped to seal the bottom of his car to the track. They help funnel the air that gets under the car smoothly and keep air from coming on the sides. Now although that was the original use of the skirts, we have been using the skirts on our robots to help us play better defense.

How Do Skirts Help Us?

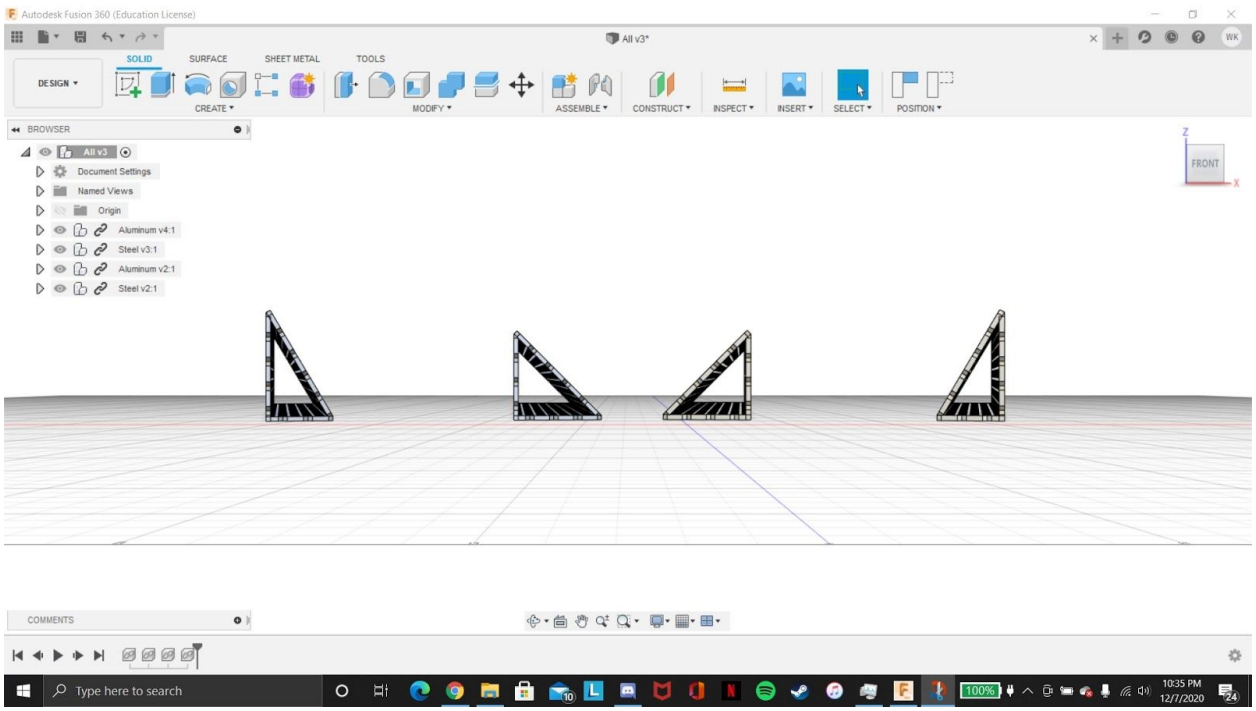
Having our skirts on an angle allows the robots who are attacking us to ride up the skirts. An attacking robot will push into the skirts providing force Wcosθ. Wcosθ has two components F_{push} and W. W is the weight of the opposing robot on the skirts; decreasing the angle of the skirts increases W. A larger W force means that there is a larger normal force pushing back up on our robot since every action has an equal and opposite one. Therefore, because the force of friction is the product of normal force and the coefficient of friction, there will be more friction between our robot's wheels and the ground and more grip to push back our opponents. F_{push} is what is left of the force applied by the opposing robot. Since a large part of Wcosθ taken up by the weight of the robot, F_{push} is much smaller than normal. Combined with the added friction of our robot's wheels, the other robot's pushing force will be greatly reduced, stopping them from being able to push us around.

Force Diagram



Our Solution To Skirts Not Being A Piece

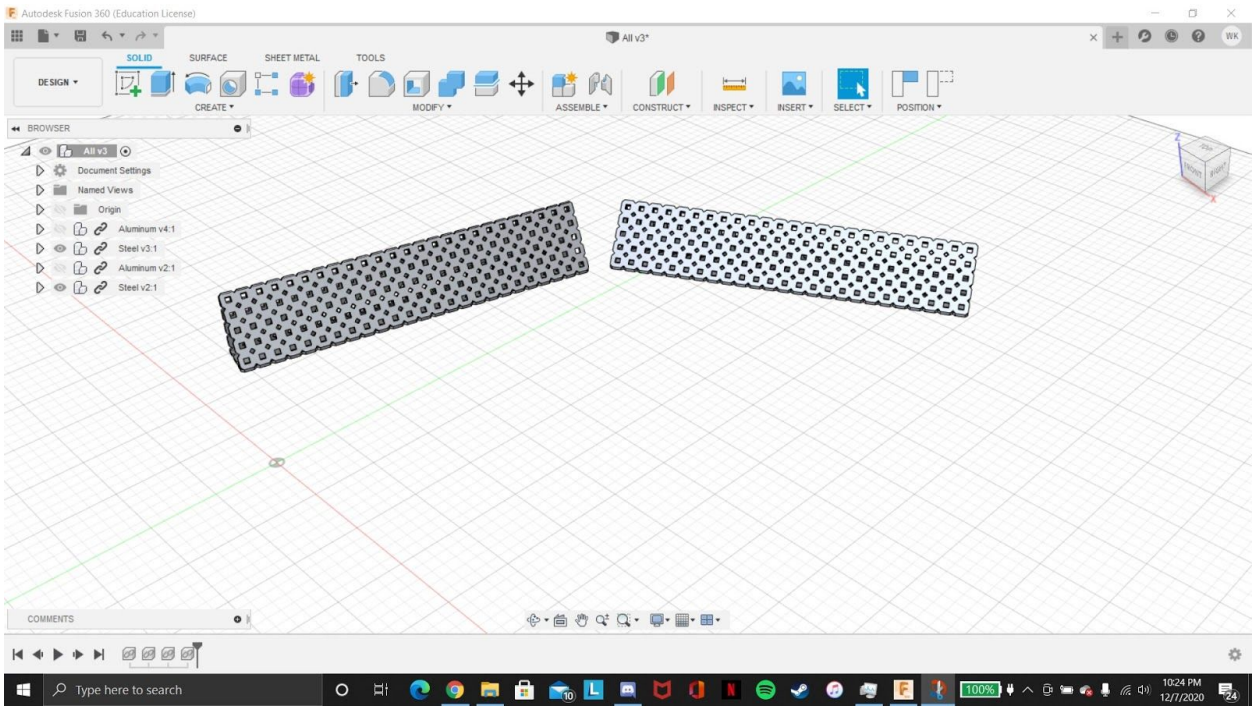
Because Vex has not started producing skirts, we have been making our own skirts by bending 5x25 steel plates with a hammer and a jig. Although it has been working, it is quite difficult and not really time effective. The pieces that we can make from plates are not as strong as the skirts that we have designed. If Vex manufactured these pieces we could attach them quickly and spend less time building our robots allowing our programmers and drivers to have more time with a finished robot.



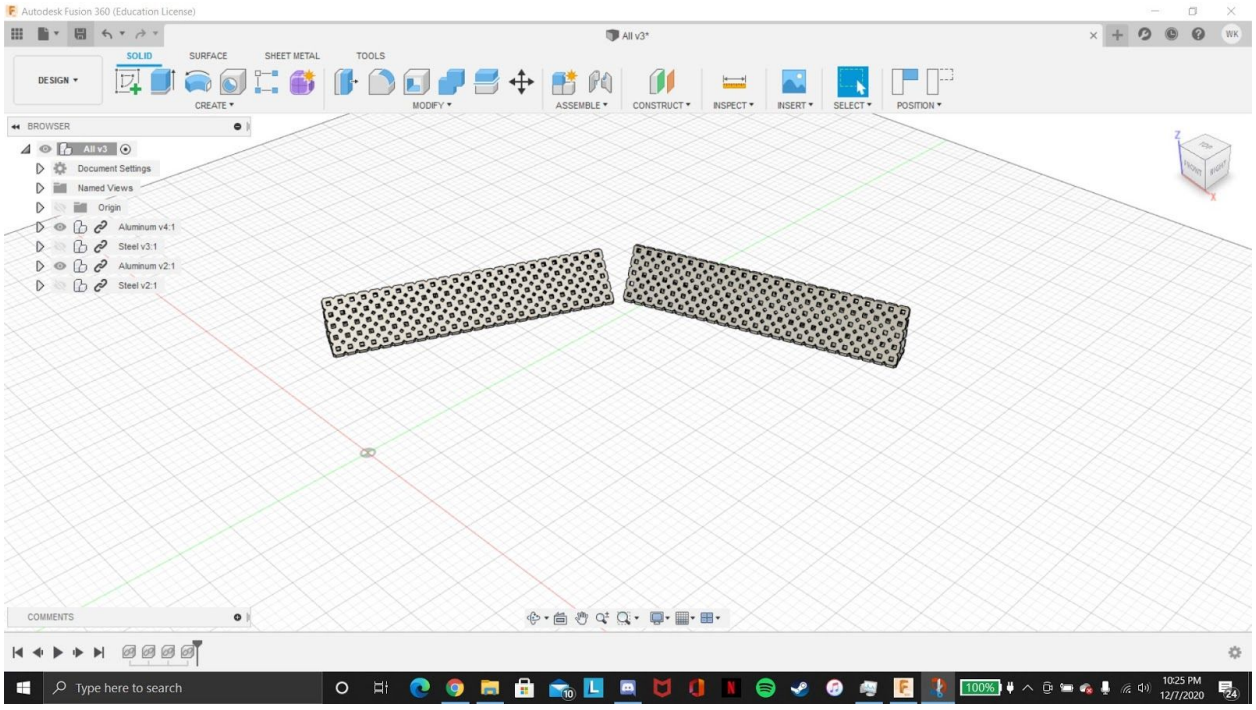
Specifications

The skirts that we have designed in Fusion 360 are both shown in aluminum and in steel. Most of the time you would want to use steel skirts because of their durability but, in some situations where you might want to keep your robot lighter, you might want to use aluminum skirts. On the upside, the skirts are hollow so the only weight being added is the framing.

Steel Skirts

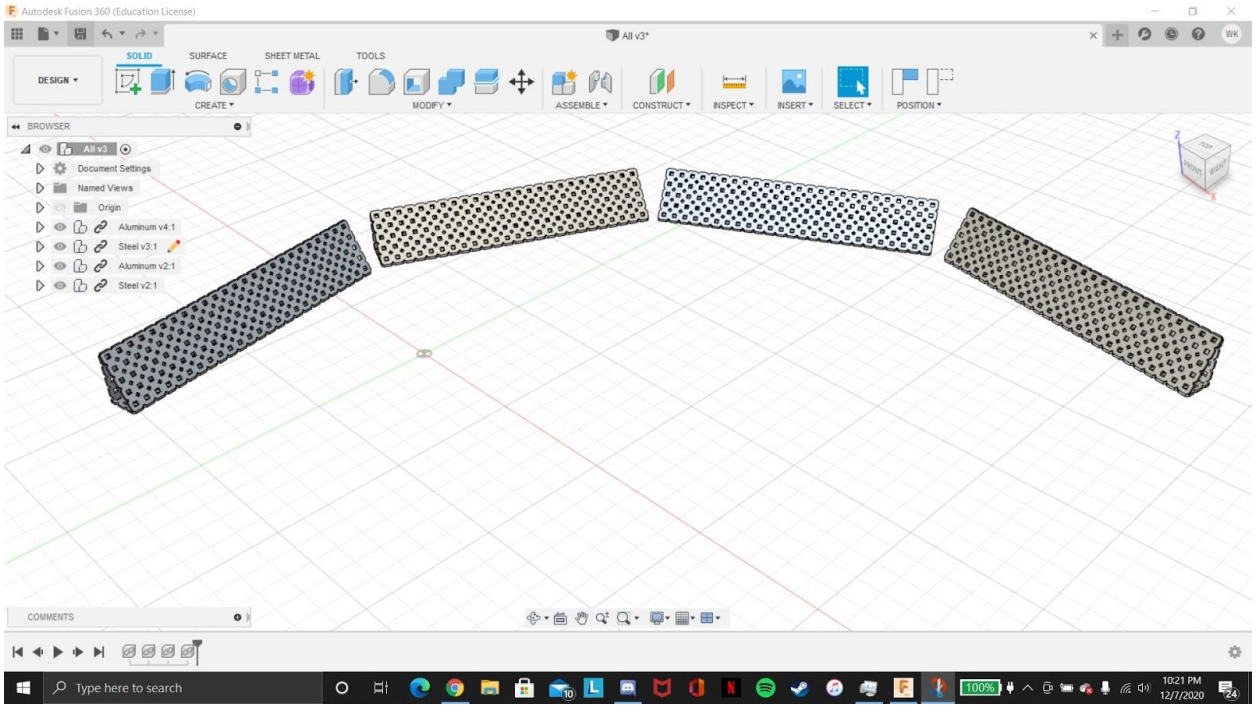


Aluminum Skirts



The Use Of Fusion 360

We used Fusion 360 2020 version 2.0.9313 to create our models. We were first introduced to Inventor in middle school and learned the basics of 3D designing. Upon entering the high school a class was offered to learn 3D modeling in Fusion 360 and Meshmixer. When we saw this challenge we asked our teacher to help us learn how to operate Fusion 360 most efficiently. I used Fusion's extrusion features to make the plates thicker so that they could be more durable. Putting the plates together was difficult at first because we were attempting to position them using the movement tool sliding and rotating them by hand. We then discovered the join tool. The join tool allowed us to click on the two lines we wanted to join and it positioned it for us. All we had to do after that was choose our angles and trim the sides to make them flush.



Conclusion

This project taught us a lot because it sped up our curriculum and forced us to learn about the areas of Fusion we needed to complete this challenge. We are planning on continuing our journey in Fusion 360 for 3D modeling in the following years to build our entire robots digitally prior to the start of the robotics season. As a robotics team that competes in most of their qualifying matches during the winter, it would be nice if we could have our model on our computers to finish building at an earlier date. With a model premade we will get more time to practice driving and to code our robots. Learning 3D design software will probably help in our career paths because we can dive into the design process of anything from manufacturing lines to the ventilation systems in a 12 story building. Having this knowledge will open doors for job opportunities.