**Exterior Double Beam Connector**

 With immense enthusiasm, we jump up and down from the front row of the audience, just as we gaze at the yellow bonus hub being stacked in the 2x2 Building Zone. In these last seconds of our finals match, we fearfully stare at the racing timer and nervously cheer on our team’s drivers as they steer the robot towards the Hanging Structure. We anxiously watch, hoping for our robot to clench onto the hanging bar and then rapidly ascend above hub level to acquire the four High Hang points, just before the timer’s concluding buzz plays. But in that moment, we hear the crowd’s energy deteriorate and so we scan the field to discover that our robot, while turning, hit the blue pillars of the Hanging Structure, causing the plow to snap off. As our drivers desperately move the joysticks to try and pull the robot backwards just in time for a hang, the timer buzzes and we sigh, dreading the costly loss of four valuable points due to our unsecured plow.

 Our plow, being a thin, protruding beam that connects to a second beam on the robot base, is poorly secured with blue connecting pegs, and so it frequently falls off during crucial times at competition and at practice. On the occasion that our plow piece snaps off, our robot can no longer effectively push hubs into the Building Zone, significantly reducing the number of points we score. Furthermore, because the plow piece is likely to fall off when the robot crashes into obstacles such as the Hanging Structure, problems can arise when driving to a specific location within a limited time frame, as depicted with the hanging bar above. The lack in having an efficient beam support mechanism also weakens the stability of our robot’s arm, which is poorly attached to the base. In further detail, the arm often moves side-to-side, causing the claw connected to the arm to interfere with our robot’s hooking device. Clearly, the VEX IQ blue pegs that are used to connect beams are insufficient, thus emphasizing the need for our new VEX IQ Exterior Double Beam Connector.

 Our Exterior Double Beam Connector would be a suitable addition to the VEX IQ parts list, as it would offer reliable and sturdy support for two beams that are to be connected. Two beams, with a width of two, could be vertically overlapped inside our Exterior Double Beam Connector, using blue custom 4x1 pegs. These custom pegs would be designed without a circular curve in the middle, allowing for our piece to be easily linked to the beams. Ultimately, with our piece encasing the overlapping segment of the two beams from the top, side, and bottom, it would be extremely difficult for the beams to snap apart, resolving the numerous problems we have encountered and described previously. Moreover, because two beams are commonly joined together to construct various components in a wide variety of robot designs, our piece will be strongly beneficial to all VEX IQ users, also allowing them to explore more complex robot designs while feeling confident that their designs will remain sturdy and well-secured. The Exterior Double Beam Connector can be easily implemented anywhere on VEX IQ robots, using black connector pieces or standard blue pegs.

 Since our team has little experience with 3D software designing, we decided to fulfill this challenge with the basic TinkerCad Version 4.4. With numerous tools and an appealing user interface, we were able to easily grasp the fundamentals of the software, and we discovered TinkerCad to be simple and visually effective. We started our design process by creating the basic rectangular prism base of our design. To create the holes where connecting pieces such as blue pegs would go, we used transparent cylinders that cut through the rectangular block. While building our custom piece, we made sure that all of the dimensions fit the current criteria from VEX IQ’s rules, so that our piece can be easily incorporated into the program.

 By taking on this project and creating a new potential VEX IQ piece, we learned several valuable lessons such as how to use TinkerCad 4.4. As a team, we hope to use the TinkerCad 3D software in the remainder of our season to illustrate our ideas and easily examine the given object from any angle. When discussing how to make changes to our current robot for the State tournament and beyond, we will consider designing our ideas on the TinkerCad software for all our team members to visualize and comprehend. We will also strive to further implement similar technology in our future robotics experience. In specific, a 3D software will be essential to use in VEX EDR, since there is little room for minor errors with all pieces being made out of metal. Thus, using Tinker, we have learned the essentials of constructing 3D blueprints, and so we plan to use this knowledge to understand more complex software platforms such as Fusion, which we can use to diagram more complex parts and layouts in upcoming seasons. By using a 3D software, we can clearly evaluate our designs and resolve issues ahead of time, before the robot is physically built. Outside of VEX, this software would be extremely beneficial when pursuing a myriad of STEM careers. For example, one of our team members is extremely passionate about car designing, and the TinkerCad software, as well as other 3D designing platforms, are perfect to visually create a blueprint of the car. The software’s benefits are applicable in this mechanical scenario, as the user would be able to pinpoint design issues before producing the car for the customer. Overall, learning how to use TinkerCad Version 4.4 software to create a visual of our custom piece helped us in many ways, leaving us with knowledge we look forward to applying throughout the rest of our STEM career.