Redesign of the Easy Rider frame focusing on materials

Jan Siksma, Industrial Design Bsc., University of Twente, The Netherlands.

Creating a concept for the Easy Rider frame based on the results found in the material research.

Van Raam is a manufacturing company of supportive bicycles. One of their models is called the Easy Rider, this model dates to 2003 and is no longer representative for the innovative character of the company. All of Van Raam's models are still made of steel whereas other bicycle manufacturers are already implementing other materials like CFRP and aluminum. Therefore, research had to be done after the possibilities of using other frame materials for a new Easy Rider and these results would be visualized in a concept frame.

To investigate possible materials for the new Easy Rider frame, first the current model was analyzed. The target group was defined and competitors were investigated. A technical analysis was performed to define al functions and specifications of the frame. After the following trend analysis, a program of requirements was made to specify the demands of the new frame. It was found that the current model has many functions, which makes the frame look technical. For the new frame, it is desirable to integrate these functions to achieve a smoother appearance of the tricycle. Comparing the current Easy Rider to its competitors showed that the tricycle is long, which obstructs easy storage and transport of the tricycle. Current customers and sellers confirmed this.

After the analysis, the material research was started, starting with material properties and how these affect the bicycle in its construction as well as in the driving behavior. It was found that materials with low elastic properties result in a very harsh ride. Main categories of the materials were defined, focusing on metals, hybrids, and polymers. Material properties and practical characteristics of these materials were gathered and compared to each other. Steel and aluminum seemed the best suitable solutions. Necessary adaptations in the fabrication hall were examined as well as new production methods suitable for new materials. Sticking to steel proved to be the easy way, but because of production techniques such as hydroforming and extruding, aluminum offers a solution. The implementation of aluminum would allow Van Raam to visually differentiate themselves from the competition. The development of the material world was followed to be able to introduce currently evolving materials which might be useful for future projects. Graphene, a material based on a single layer of carbon atoms, is one of the promising materials. Currently large-scale production of the material is facing difficulties which affects the price of this material.
With the information of the material research, a material was to be selected. Steel and aluminum indeed proved to be the best solution for Van Raam and therefore this recommendation was made. Although improvements can still be made while sticking to steel alloys, aluminum was selected as the material to follow with for the concept generation phase. The goal of this choice was to be able to show the possibilities of the material instead of intruding a material.

After multiple ideations, a concept was created visualizing the possibilities of aluminum. Extrusion profiles proved to be a solution for the integration of functions. Seating rails as well as luggage carriers and cables were integrated using extrusion, but due to the form of the profile other functions like attachments for the chainguard can be implemented easily as well. The independent suspension of the rear wheels partly covers the harsh ride of an aluminum frame. The front view of the tricycle was improved by a part which combines hydroforming and 3d-lasercutting technologies, resulting in an easily accessible, integrated battery.

As mentioned, the choice of aluminum may not be the best overall choice and the concept only visualizes the possibilities of the material. For the real implementation of aluminum more research still must be done on for instance the producibility for which an introduction has been given. Post-welding heat treatments should be considered and long-term sustainability should be tested. Also, changing to aluminum brings costs. Investments must be made to both acquire new knowledge on the material as well as to suit the manufacturing to aluminum.