The Engineering Design Process of the Harley Davidson V-Rod

I. Recognize the Need
During the Harley Davidson video, we observed the many stages of the engineering design process. First, the executives at Harley Davidson recognized the market pull from consumers for a faster motorcycle, capable of putting out speeds at the level of competing companies. They also realized they had been using the same technology in their engines for a long time, and were losing ground in the industry. To address this problem, they decided to use the engine from their racing bikes in a street bike.

II. Define the Problem
The problem facing the executives was the need for a faster bike, but creating this without sacrificing the trademark look and sound of a Harley Davidson. This is especially difficult due to the fact that the new engines has a completely different shape and sound than previous engines. To solve this, they had to research and develop an entirely new frame and body for the bike.

III. Gather Information
In order to facilitate the design of this new model, the designers looked back through the designs of previous bikes produced by the company. The company also reached out to Porsche for aid in the design of the engine, due to their status as the best engine designers in the world. Harley Davidson sent a team of engineers to the Porsche headquarters in order to work more closely with the company.

IV. Generate Conceptual Ideas
After pouring through the old designs, the design team began drawing up conceptual ideas for what the bike may look like. The concern among the team was fitting the larger engine into a street bike without sacrificing style and shape. The designers decided on a sleek, all aluminum body, which would make the bike stand out against any other bike on the market. While generating designs for the bike, the engineers recognized a problem with the size and location of the gas tank. Because of the larger engine, the tank had to be moved from just behind the handlebars to under the seat.

V. Compare, Combine and Select Ideas
After the initial design process, the team settled on a design for the bike. The main properties the bike would need to have were a two bar, bent frame system, as well as the handlebar properties of low-rider bikes, with the larger angle between the handlebars and the body helping to fit the larger engine. During this process, engineers had to work closely with designers to compromise
between the functionality and the style of the bike. To obtain the best possible balance of functionality and style, the engineers and designers had to go back and forth many, many times to settle upon a final product.

VI. Analyze and Design
The ideas settled upon by the group were then solidified into a design using computer aided design software, creating a three dimensional model of the bike, without wasting any resources. This design was changed many times to assure the highest quality design. A model was then made out of clay to help visualize the bike at an actual scale, without actually making the parts for the bike. The clay model allowed designers and engineers to tweak certain aspects of the bike, such as the exhaust, which utilizes a hidden chamber inside what looks like two separate exhaust pipes to maximize the volume of the pipe.

VII. Fabricate and Test Prototypes
The team then fabricated prototype bikes using some hand made, and some premade parts. During this process, several problems arose, such as the size and shape of the gas tank and the method used to create the bent frame. To combat these problems, the team decided on a plastic gas tank, capable of forming to any shape they needed, allowing for more gas storage, as well as using a method utilizing high pressured water to bend the frame to shape. The prototypes then went through a series of road-stress tests, both inside and outside of the design labs. These tests measured the bikes durability through bumpy roads, wet conditions, long hours of continuous use, as well as intense heat. The bike also completed many sound tests, not only to make sure it met sound regulation standards, but also to assure it kept the signature Harley Davidson sound. The innovative design of the exhaust pipes allowed for the bike to not only achieve the Harley Davidson sound, but also the signature look.

VIII. Communicate the Design
To communicate the previously top-secret design, the company staged a big reveal at the annual Harley Davidson showcase, allowing the product to reach its target audience almost directly. Besides all of this, the company also made several advertisements such as poster and television commercials.

Conclusion
The V-Rod motorcycle was the product of six years of hard work, patience and overcoming substantial obstacles. These six years consisted of research to find the best possible design for the bike, compromise between engineers and designers to couple form with function, as well as rigorous prototyping, testing and redesigning to ensure the company produced the highest quality product possible. This entire process is a perfect example of the many steps of engineering
design required to develop and produce a quality item that brings the best available technology and materials together in one product.