In the early 1990’s the motorcycle industry started to shift into a series of more developed, faster bikes, built mainly for racing. Harley-Davidson wanted to improve their style of motorcycles to keep up with this shift in the industry. They wanted to create a fast bike in the classic “Harley” style. The engineers working for Harley-Davidson wanted to use the VR-1000 engine in order to make the bike fast. This engine would be a new thing for Harley, as it was liquid-cooled while everything else they had used was air-cooled. This difference was the main issue for Harley’s engineers. Placing this bigger engine into a small street-bike frame created many problems. This engine was originally used in racing bikes, which were not run for long enough amounts of time to require the use of a radiator. So Harley’s engineers also needed to confront the problem of creating a long-term way to cool the engine. This project took six years to complete, and during the motorcycle’s production, it was named P4 Digger.

At the start of the process, the engineers would work to create efficient designs, and Willie G. Davidson would turn them down solely because he didn’t like the way they looked. Throughout the creation of the motorcycle, engineers had to collaborate with stylists and Willie Davidson to create an attractive Harley that would run properly. They started out with the original Harley frame, and quickly discovered that the VR-1000 frame would not be able to fit. In response, engineers came up with the idea to create a two-rail frame instead of the traditional one-rail frame. They came across some issues
concerning the bending of the pipes, and eventually used hydroforming, a process of bending a steel pipe by applying high-pressures of water to it. This process does not affect the strength of the metal, making it an excellent choice for the creation of this bike. The engineers also worked with the offset angle of the front wheel, to maintain the traditional style of a Harley-Davidson bike.

The second big concern was fitting an attractive new radiator into the bike. This was a hard task, due to the engineer’s inexperience working with this type of engine. They went through several designs, which failed tests either because they did not function properly or did not meet the stylist’s standards. First, the wheel blocked air flow into the radiator, so they decided to add large fins on either side to catch the air. The engineers thought that this was the answer, but it was awkward and unattractive, and it also didn’t work. Air rushed in one side of the radiator, and right out the other. After further testing, the engineers found that the addition of protruding rivets to the fins solved this issue. The rivets created an air vortex-generator that efficiently cooled the engine. As another way to cool the engine, they tried to add a fan into the design of the bike. The original fan was two large, so they settled on two fans, one on either side of the engine.

The placement and size of the gas tank created yet another issue. Originally, they had a metal tank that only held one gallon of gas. One engineer suggested something completely foreign to the Harley motorcycle industry: plastic. A plastic gas tank would be easily molded into small corners, allowing it to be much larger, around three and a half gallons. Another good thing about plastic is that it is heat-resistant, and more durable. The engineers also found problems with the exhaust. The original material they used to make the exhaust was too heavy, so they used aluminum. Aluminum had never been used on a Harley bike before, but it turned out to be a good thing because it is corrosive-resistant. They were using a straight dual exhaust, but it could not compensate for the volume of air running through the exhaust pipes. To fix this, they designed an exhaust that went from two pipes to one pipe then back to two pipes, without changing the style they desired.
Before the bike could be street-ready, it needed to pass a long series of tests, one being the Dusseldorf test. This test required them to drive the bike on the Autoban for five hundred hours without an issue. Another test tested the Harley’s ability to idle, in preparation for the traditional Harley parades. This test required the bike to be driven for one hour, then parked and idled for an hour. This process was repeated for 24 hours to ensure that the bike would not overheat. They also did tests to check for the signature Harley sound, performed in an anacoic chamber. They also did an extreme water test, and an extreme radiation test, to ensure that the bike would work in the real world.

After all these tests, the bike was finally complete. Throughout the last year of the project, the naming process began. After discarding all the names that were trademarked by other companies, they decided to call it the V-Rod. They liked this name because it was stylish, attractive, and would draw attention from customers. The process and creation of the Harley-Davidson V-Rod is an ideal example of the engineering design process.