Ford Otosan

Truck manufacturer cuts time to reproduce 1.2 million kilometers of customer use with Simcenter solutions

Product
Simcenter

Business challenges
Understand lifetime vehicle loads
Avoid unnecessary cost and weight associated with over-dimensioning
Reduce the risk of customers experiencing failures
Define an accelerated schedule for proving ground testing

Keys to success
Use innovative load analysis to quantify vehicle durability potential
Use Simcenter testing solutions to replace onerous tests by deriving compressed load-time histories
Enable Simcenter Engineering services to create accelerated proving ground test scenarios to represent customer usage

Siemens PLM Software product and services help Ford Otosan leverage accelerated durability testing cycles to cut weight and costs

Durability sells
Executing extensive field tests to validate the durability performance of a vehicle is expensive and time-consuming. This pressures automotive original equipment manufacturers (OEMs) to develop compressed testing cycles and efficiently reproduce equivalent laboratory tests. In addition, durability engineers have to gain a precise understanding of the loads the vehicle will undergo during its lifetime to guarantee valid fatigue performance testing.

Ford Otosan is a joint venture between Ford Motor Company and Koc Holding, each holding 41 percent of the shares. The remaining shares are held publicly. Headquartered in Kocaeli, Turkey, the company employs over 11,500 people in engineering, manufacturing, sales and marketing and parts distribution. Ford Otosan develops and produces light, medium and heavy commercial vehicles, engines and powertrains.

Durability is strongly related to brand image and a crucial selling point. Ford Otosan is committed to creating products that customers appreciate for their design, high quality, technology and driving experience. As a result, a Ford Otosan team, which included Berk Ozoguz and Emre Baytekin, worked with Siemens PLM Software to develop a compressed durability testing cycle for its new road truck, in the early
Simcenter Engineering experts developed load sequences that achieved a significant time reduction, while keeping a sufficient correlation to the target.”

Murat Arslan
Vehicle Durability Supervisor
Ford Otosan
using Simcenter Tecware™ software, part of the Simcenter portfolio, for load data processing to eliminate spikes, drifts, sensor failures and other anomalies.

The same software was used to conduct rainflow data analysis by counting pairs of reversals of loads or accelerations, which indicate material fatigue damage. They displayed the results in a rainflow matrix format that showed how often events of particular amplitudes occur, and extrapolated the data to estimate the damage generated by road testing over the full 1.2 million kilometers. This extrapolation was based on Ford Otosan’s targeted weighting mix of highway, local roads, and city driving without off-road and construction site usage. The goal was to achieve the full 1.2 million kilometers without any cracks in the major components of the vehicle.

Since one of the objectives of the project consisted of defining an accelerated schedule for proving ground testing, the Simcenter Engineering experts had to create a reference database of rainflow matrices for the proving ground. After the field tests in Turkey, the test vehicle was shipped to Belgium where engineers re-instrumented the vehicle exactly the same way as in the road tests and ran it on the Ford proving ground in Lommel, Belgium. They collected road load data for each of the test surfaces on the proving ground and converted the time histories to rainflow matrices using the methods described above. At this point, Simcenter Engineering experts had created two reference databases that consist of rainflow matrices, one representing Turkish roads and the other the test track.

Defining the test sequence
Arslan explains, “The next phase aimed at calculating the optimal mix of test track sequences and events that match the 1.2 million kilometers target. For example, these analyses might determine that 200 passes on the Belgian blocks, 70 potholes and 50 off-road circuits are required. Simcenter Tecware software enabled us to set specific objectives for the load sequences, such as minimizing the time required to perform the tests or achieving the best correlation regardless of the time involved.”

Using Simcenter Tecware enabled us to take each of the channels of load information into account to ensure the damage content was equivalent for each channel between the test track and road load matrices over the entire period of the test. Another constraint was to ensure that, for example, the early part of the test track sequence did not overstress one particular area and cause a premature failure that in the road load sequence would not be seen until the end of the test.

“Simcenter Engineering experts developed load sequences that achieved a significant time reduction, while keeping a sufficient correlation to the target,” says Arslan.

Running accelerated testing
Having closed the test schedule preparation job, Siemens and Ford Otosan continued their joint project by running the defined test series on the track and assessing the vehicle’s fatigue resistance. The vehicle was inspected at regular intervals to see if any cracks had appeared. The Simcenter engineers documented each failure with a description and photographs and provided them to Ford Otosan engineers, who used them to improve the design to fix the problems and build a new prototype. After several build-and-test cycles, Ford Otosan had modified the design to the point that it passed the entire test track sequence.

In parallel, the Simcenter Engineering team also used the proving ground test schedule to create a sequence in order to test the truck cabin on a four-poster durability test rig. Testing the cabin on such a durability rig makes it possible to optimize its fatigue performance before proving ground testing, since the physical prototype of the truck cabin becomes available before the full-vehicle prototype.

“The truck cabin test on the four-poster durability test rig took only four weeks, about half the time required for the proving ground test cycle.”

Murat Arslan
Vehicle Durability Supervisor
Ford Otosan

The condensed durability test schedule is based on real customer usage.
Solutions/Services
Simcenter Engineering
Simcenter Tecware

Customer's primary business
Ford Otomotiv Sanayi A.S. (Ford Otosan) was founded in 1959 as a joint venture between the Ford Motor Company and Koc Holding. It is based in Turkey with five facilities employing 11,500 people producing the Ford Transit, the Transit/Tourneo Courier and Ford Trucks. www.fordotosan.com.tr

Customer location
Kocaeli, Eskişehir, İstanbul Turkey

Testing the cab on a rig is also faster because it eliminates the downtime experienced on the test track, such as for making repairs to secondary systems not covered by the test.

“The truck cabin test on the four-poster durability test rig took only four weeks, about half the time required for the proving ground test cycle,” says Arslan.

Reliable fatigue testing
Developing accurate load scenarios for durability engineering is critical for coming up with reliable durability assessments. Any inaccuracies may result in unnecessary cost and weight associated with over-dimensionalizing the structure or the risk of customers experiencing failures.

“Simcenter Engineering experts developed a target durability test track sequence that accurately replicated the excitation of the actual road and significantly reduced the amount of time that would have been required for road testing,” explains Arslan.

“The Simcenter Engineering team performed the complete test preparation cycle for us, from preparing the data collection tests, instrumenting the vehicle, performing tests on both the test track and local roads and processing the road load histories to meeting our customer’s durability objective and developing test sequences for both track and rig,” says Arslan.

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