

# SIEMENS

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Automotive and transportation

## Daimler Trucks

Premier truck manufacturer enhances durability testing with the help of Siemens Digital Industries Software

### Product

Simcenter

### Business challenges

Fulfill durability requirements for a huge variety of product models

Meet the specific product durability needs of customers in different regions

Enhance durability of trucks with improved testing and validation techniques

### Keys to success

Improve durability through use of simulation

Implement full integration of test and simulation procedures

Leverage data generated on the proving grounds

### Results

Enhanced durability testing

Improved measurement instrumentation and execution of data collection

Integrated test and simulation procedures

Generated high-quality results on the test track

### Daimler Trucks uses Simcenter Tecware and services to boost measurement instrumentation and data collection

#### Meeting diverse needs

With brand names such as Mercedes-Benz, Freightliner, Western Star, Fuso and BharatBenz, Daimler Trucks is one of today's biggest globally active developers and manufacturers of trucks. Asia accounts for 32 percent of unit sales, followed by the North American Free Trade Agreement (NAFTA) region (27 percent), Europe (22 percent) and Latin America (15 percent). The huge product variation – light, medium and heavy trucks for local and long-distance deliveries, heavy load and off-road applications, as well as special

vehicles like fire engines, tippers, concrete mixers – and the additional choice of wheel-base and wheel drive configurations creates an enormous variety of models.

“We aren't only obliged to meet these customer demands on the global market with different brands and product designs,” says Dr. Christof Weber, who manages the Daimler Durability and Bench testing Competence Center in Wörth am Rhein. “But we are also challenged by a diversity of reliability needs; on top of this, we have to meet evolving environmental standards and control the total lifetime cost of the truck. These constraints vary from market to market. With respect to durability, and considering all the different standards and customer needs, defining the appropriate design targets is not an easy task.”



### **Durability is key**

The critical question for durability engineers is always the total cost of ownership of a truck, so the added value of durability engineering is very clear.

“Durability defines the long-term perception of the product, radiating reliability and robustness, and also dictates the residual value of a truck on the second-hand market,” says Weber. “Next to this, a truck needs to be absolutely safe under all conditions.”

Truck durability standards are much more demanding than for those of a passenger car, and also differ from market to market.

“Mercedes-Benz cars are designed to withstand 300,000 kilometers (km) without major repairs,” says Weber. “Long-haul standard trucks are designed to last 1,200,000 km. Of course, harsher environmental conditions, more overload and more dynamic driving will shorten the life expectancy of the truck.

“For example, in Brazil, the same standard, unreinforced trucks will only last 900,000 km. But at the same time, we know of 30- and even 40-year-old trucks that are still in daily use. You might have to change the engine or the axles, but as a backbone, the chassis should never break.”

Daimler Truck’s durability testing and validation procedures are very customer-usage oriented: “We call it application-specific testing,” Weber says. “It’s based on customer usage profiles, market intelligence and expectations, and field measurements from all over the world. Siemens Digital Industries Software is our partner in the business of retrieving all this information. We also do measurements together with customers in their specific applications. This way we learn how a truck is used on a day-to-day basis.”

The usage intelligence gained from these customer trials is linked to each cell of the application matrix, and varied by putting a scatter of distribution over the parameters.

*“We very much appreciate the collaboration with Siemens Digital Industries Software, especially the fully integrated service offered. It is not only about evaluating data; when needed, Siemens Digital Industries Software can provide us with the full line of services.”*

Dr. Christof Weber  
Daimler Durability and Bench testing Competence Center  
Daimler Trucks



“By adopting these statistical methods, we are able to simulate more or less 100,000 different customers for each application cell,” Weber says. “With this enriched application matrix, we can define design targets for truck applications throughout the world.

“Working on durability starts with simulation. We try to get as much work done in the low-cost areas early in the development process by means of simulation and limiting the amount of field tests as much as possible. Simulation accuracy is assured by conducting specific tests and constant feedback loops between test and simulation. Of course, this approach necessitates the full integration of simulation and test procedures.”

Testing all variants would be far too costly and time consuming; therefore, a specific vehicle combination is selected to represent an entire platform range. Only this one vehicle will undergo a rig test or a complete road test.

“If you are able to map the mutual influences for different systems in a truck, you automatically know how many variants you need to test,” says Weber. “The truck selection is based on targeted simulation and long-term engineering experiences. The design of experiments (DOE) is a very

helpful tool. It lets you estimate how different components will interact and how this will affect the truck’s overall durability.”

#### **Understanding specific market requirements**

Proving grounds play a key part in the rollout of Daimler Trucks’ application-specific testing philosophy. The 2007 state-of-the-art proving ground in Wörth am Rhein is part of the Development and Test Center at the Mercedes-Benz Wörth plant, the largest commercial vehicle plant worldwide.

The new 550,000 square-meter proving ground is designed to recreate a relevant set of road and terrain conditions from around the world. The outside test lanes include grades of up to 26 degrees. These lanes are used for function testing, such as brake tests. The inside area features a full variety of rough-terrain tracks, with 14 different types of road surfaces covering the entire spectrum of world road conditions, from highway to dirt road. Test drivers are assisted by a global positioning system (GPS) that helps them to perform repeated test routines consistently while adhering to the engineers’ instructions.



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Testing Competence Center  
Daimler Trucks

“By cleverly combining customer profiles with specific track characteristics, we’re able to design a durability test track program profile that accurately represents a specific market requirement,” says Weber. “It’s basically a very simple idea, yet it requires a complex manipulation of data, which you have to translate into a test program, telling the test driver exactly how many times and at what speed he has to drive different circuit sections, representing, for instance, the application profile of a Brazilian customer.”

For the test driver, it is not so easy to keep all these parameters in mind while driving; therefore, every test vehicle at the Würth test track is controlled with a GPS. This allows the test engineer to remotely check if the driver is performing according to the brief. A cockpit display informs the driver about his actual and target speed, and possible tolerances. The driver can also be warned through acoustical feedback.

Daimler recently inaugurated its new state-of-the-art production facility in Oragadam, India. The site also houses an integrated research and development center and test track. The facility will produce light to heavy BharatBenz trucks from the third quarter of 2012. The Indian test facility is spread across approximately 19 hectares and has two different tracks.

The three-lane outer track has a total length of 1.55 km and is specially designed for testing the power train and driving noise. The two-lane inner track is 1.16 km long and includes a variety of poor road features specific to India. The track also offers special testing opportunities, including a water trough, a dusty road and poor road surfaces. Facilities for testing on grades and steering will be added in the near future.

### Solutions/Services

Simcenter Tecware  
[siemens.com/simcenter-tecware](https://www.siemens.com/simcenter-tecware)

Simcenter Engineering  
[siemens.com/simcenter-engineering](https://www.siemens.com/simcenter-engineering)

### Customer's primary business

Daimler Trucks develops and produces vehicles in a global network under the brands of Mercedes-Benz, Freightliner, Western Star, Fuso and BharatBenz. It the biggest globally active manufacturer of trucks above six metric tons gross vehicle weight, and has 27 production facilities around the world.

[www.daimler.com/company/business-units/daimler-trucks](https://www.daimler.com/company/business-units/daimler-trucks)

### Customer location

Stuttgart  
Germany



### Forging a strong collaboration

The Durability and Bench Testing department of Daimler Trucks and Siemens Digital Industries Software work together very intensively.

“At first we called them to support us,” Weber says. “But this has developed into a strategic partnership: Siemens Digital Industries Software equips our test vehicles with state-of-the-art sensors and measurement equipment. Strain gauging according to industry standards is an important part of this. Excellence both in measurement instrumentation and in the execution of the data collection are our absolute priority.”

“Measurement campaigns on proving ground and in the field are also performed together with the Simcenter Engineering teams and a Daimler test engineer. The Simcenter Tecware software tool has become an integral part of our everyday operation. Generating high-quality test results is critical.”

“We very much appreciate the collaboration with Siemens Digital Industries Software, especially the fully integrated service offered. It is not only about evaluating data; when needed, Siemens Digital Industries Software can provide us with the full line of services.”

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