



## Feature

# The world's largest test rig – a powerful tool in the hunt for increased payload

**The profit margin for many European haulage firms is just two percent. This means that every extra kilogram that a truck rig can carry may make a big difference. That is why Volvo's engineers are investing heavily in weight-optimising their truck from the wheels up. They are helped in this process by the world's largest test rig.**

“The truck is a working machine with a price per kilo, irrespective of application area,” says Göran Johansson, head of Volvo Trucks' department for durability testing of axles, suspension units, steering and brakes.

Efforts to optimise the truck's weight focus largely on testing new, lighter materials and designs without compromising on quality. This is where Volvo Trucks' test rig comes into the picture. In it, all new axles and suspension systems undergo rigorous tests to analyse their strength and durability.

“Volvo has the world's largest test rig for axles and suspension systems. No other rig can deal with such massive forces as our rig can,” reveals Göran Johansson.

Cutting weight from the chassis itself is a challenging task for Volvo's engineers. The fact is that the proportion of a truck rig's weight represented by the actual cargo has dropped over the past few decades. There are several reasons for this: drivers opt for accessories that increase the vehicle's weight, high fuel prices mean that customers want larger fuel tanks so they can fill up where it is cheap, and finally there is emissions legislation – Euro 3, 4, 5 and the forthcoming Euro 6 – whose flip side is heavier exhaust clean-up technology.

Carrying a higher proportion of cargo has the greatest impact on long-haul routes, where maximising the truck's cargo-carrying capacity is immensely important.

Volvo Trucks' calculations reveal that if the cargo weight of a typical European long-haul rig\* is increased by one kilogram, this raises the truck's annual income by SEK 20-30 per year (EUR 2-3 per year). In an industry where the average profit margin is about



2 percent, this additional revenue makes a difference. Increasing cargo capacity by 200 kg for a haulage firm with 50 trucks in long-haul operations means that revenue increases by SEK 200,000-300,000 a year (EUR 20,000-30,000 a year). For a transport firm in weight-sensitive operations such as tanker or bulk-goods haulage, the corresponding figure is 10 to 15 times higher.

When Volvo tests new weight-optimised materials and designs, it is vital that they are subjected to the stresses encountered during real-life operation. This process starts on Volvo Trucks' proving ground in Hällered.

“We put the trucks through as many different operating environments as possible on our proving ground to replicate our customers' everyday operations around the world,” explains test engineer Magnus Larsson. “There are potholes, hills, washboard surfaces, sharp bends, acceleration and braking sequences – in fact, everything that a truck might encounter in operation. While all this is going on, we record the vehicle's progress in the form of digital signals, which we later copy and convert into a program that we replicate in the test rig.”

The engineers cut out all non-essential information such as all stretches on smooth straight roads with low loads and long-distance cruising, retaining all situations that put the truck under considerable stress.

“It's a bit like a music studio where they mix in the various instruments. What's important for us is to include the right loads and frequency ranges and take care not to filter out any data that may be small but nevertheless important for the end result,” says Magnus Larsson.

The rig is operated from a control room with a signal amplifier and control electronics where programming of the various driving environment profiles is dialled in. Once all the installations and control programs are ready, what remains is monitoring and adjustments during the course of the test.

“It's similar to working in mission control at a rocket site,” says test engineer Emil Skoog who is responsible for the rig.

The time savings compared with the lengthy testing of axles and suspension systems out on the test track are invaluable. The shorter test duration in the rig also makes it possible to release new features and products much sooner, and to meet customer needs or new legislative requirements.



The rig also gives Volvo's engineers greater freedom: an idea can be rejected or prioritised much sooner, which prevents time being wasted on ideas that do not work.

Without test rigs and test tracks, it might take five to ten years to test a new lighter axle design in a customer's fleet. On the proving ground, the test process would take between six and twelve months, whereas the test rig can complete the same test in two months. Moreover, the rig offers greater precision.

"Our measurements are precise to within about one percent. What's more, this percentage error margin in our measurements has no significance when all the other factors are weighted in, such as the way a driver drives or loads the truck. Our aim is to make sure that our products stay the course once they reach our customers, tailored to the requirements of the various markets," says Emil Skoog.

\*4x2 truck with three-axle trailer in General Cargo operations, 40 tonne gross weight, covering 160,000 kilometres a year.

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### **Volvo's test rig**

The rig measures 14 x 8 metres and is 4.5 metres high.

It weighs 220 tonnes and rests on a foundation (a seismic mass) that weighs 980 tonnes. The hydraulic system has 12 pumps with a combined effect of 2000 kW and a capacity of 4900 l/min, with up to 210 bar of pressure.

Updating frequency for the test rig's control electronics: 1024 Hz.

### **Captions:**

T2010\_1377:

Engineers Emil Skoog and Magnus Larsson have the world's largest test rig as their work tool. Volvo invests considerable resources in hunting down excess weight. Every kilogram shaved off a chassis means that the customer can carry one kilogram more cargo and thus offer more competitive haulage prices.

T2010\_1378:

The rig has been dimensioned to handle full-scale tests with axle installations up to a 32-tonne bogie. Volvo is the only truck manufacturer in the world to have such a high-capacity facility.

T2010\_1379:

Volvo's weight loss experts Emil Skoog, Göran Johansson and Magnus Larsson. Volvo's test rig has significantly cut the time needed to test new systems. On a test track, the time required for a complete test is six to twelve months, whereas the rig can



complete the same test regime in a maximum of two months. This gives engineers greater freedom to test more daring ideas.

T2010\_1380:

Test engineer Emil Skoog in the control room:

“It’s similar to working in mission control at a rocket site. Once all the installations and control programs are ready, what remains is monitoring and adjustments during the course of the test.”

T2010\_1381:

The rig is placed on a flat bed made of steel that is bolted securely to a concrete foundation. Under this foundation, which weighs 980 tonnes, there is a layer consisting of 36 air-filled rubber bellows to isolate the building from the enormous forces unleashed by the rig.

T2010\_1382:

Magnus Larsson and Emil Skoog beside one of the rig’s 24 hydraulic cylinders, six for each wheel, which simulate on-road driving. The power can be applied vertically, longitudinally or laterally on the axle being tested.

T2010\_1383:

Göran Johansson, head of Volvo Trucks’ department for durability testing of axles, suspension systems, steering and brakes.

**Link for downloading images:**

[http://icp.llr.se/CumulusE\\_Z/VTC\\_ImageGallery/Login2.jsp?assets=T2010\\_1377;T2010\\_1378;T2010\\_1379;T2010\\_1380;T2010\\_1381;T2010\\_1382;T2010\\_1383.tif](http://icp.llr.se/CumulusE_Z/VTC_ImageGallery/Login2.jsp?assets=T2010_1377;T2010_1378;T2010_1379;T2010_1380;T2010_1381;T2010_1382;T2010_1383.tif)

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