




ROLLING ROAD

		
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Abstract

An important part of the test-programme of heavy vehicles is the endurance test. Such tests are usually carried out on a proving ground. It has long been a wish of VDL Weweler, a Dutch manufacturer and supplier of air suspension systems, to perform such endurance test in-door. For that reason, to perform endurance tests of complete suspension systems, Weweler developed an indoor Rolling Road Test track. This Rolling Road test bench is unique and one of the biggest known in Europe. This HVTT15 paper will address the objectives for realization and intended test options for this test bench, the technical design of it and the choices made in that, and the actual use and validation against proving ground results.

Keywords:

- Indoor endurance test for heavy duty vehicles
- Accurately reproducible
- Includes dynamic tyre behaviour
- All frequencies can be simulated

1. Introduction

VDL Weweler located in Apeldoorn The Netherlands is a manufacturer / supplier of air suspension systems, producing their own flexible trailing arms in house and is belonging to one of the companies in the VDL Group. To be able to perform endurance tests of complete suspension systems Weweler developed an indoor Rolling Road Test track, see figure 1.

With the help of VDL this special equipment has been realised near Eindhoven as one of the 4 Shared Facilities at the Automotive Campus in Helmond.

This Rolling Road test bench is quite unique in the world and one of the biggest known in Europe. Fatigue and endurance tests can be simulated without the use of a pave test track with cobble stones and without destroying a complete vehicle combination of truck and trailer (and driver). With this embodiment these tests are accurately reproducible.

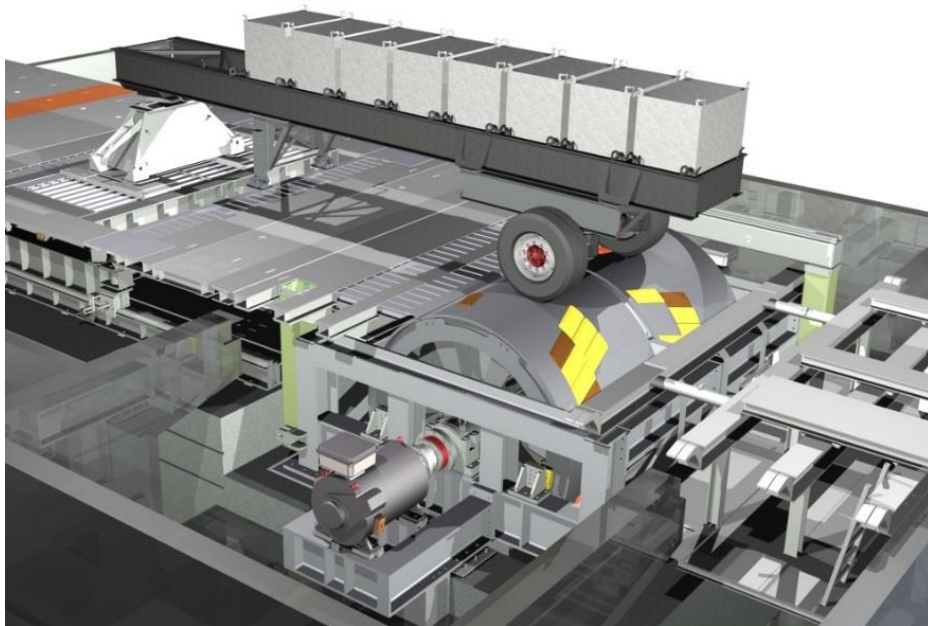


Figure 1.: Layout of the Rolling Road Test track

The HVTT15 paper will address the objectives for realization and intended test options for this test bench, the technical design of it and the choices made in that, and the actual use and validation against proving ground results. The objectives for the test bench are included in the next section. The research and design approach can be found in section 3. Expected use of dynamometer is addressed in section 4, and we close with conclusions and discussion.

2. Objectives

The Rolling Road test Facility has been designed with the objective to offer an indoor alternative for outdoor endurance testing, and for assessment of the behaviour of heavy duty vehicles such as trucks, buses, trailers. (suspension, critical components,) under vibration conditions and so the influence of the dynamic behaviour of wheels and tires are included.

3. Research approach

With the help of VDL and the Dutch Ministry of Economic Affairs, the Province of Noord-Brabant, the municipality of Helmond and the cooperation Region Eindhoven, this complete construction was realized as a shared facility. The dynamometer was realized by VDL and Automotive Facilities Brainport Holding. The Automotive Facilities Brainport Holding is an organization in which Tass International / TNO, Benteler, VDL participate, and the municipality of Helmond have a seat. The test bench is leased to VDL and third parties.



Figure 2.: The Rolling Road test facility in use

See figure 2 for some examples of the use of the test facility.

Design

The test bench was initially built for testing the suspension systems of VDL Weweler. The idea of testing a complete suspension system with axle and wheels on a roller was an earlier idea of Weweler's R&D as an alternative to testing trailers and trucks on a special test track with cobblestones. That idea of the dynamometer has been developed by VDL Weweler and the design of the entire bench is realized during 10 years with various interruptions.

Together with people from DAF Trucks, the Eindhoven University of Technology and also with students from the HAN University of Applied Sciences, it was investigated how to simulate a test track with realistic performance between obstacles and vehicle.

The dynamometer actually consists of two large rolls of three meters in diameter on which cleats (obstacles) are placed. Due to the specific position of the cleats, variation in the rotational speed of the rollers and the ever-changing position of one roll relative to the other, you get the same effect as when driving over a test track with cobblestones.

The whole construction is placed in a large pit (5.5 meters deep, 20 meters long and 13 meters wide). This pit is covered with steel plates, so that only the rollers protrude a bit above it. After the trailer, truck or bus is placed and well-fixed the drums will turn and the wheels rotate. This simulates the actual situation as well as possible. Nearly the whole frequency spectrum can be

simulated¹ and this dynamometer gives VDL the possibility to perform several tests in a shorter time.



Figure 3.: The suspended test bench support (32 air bellows)

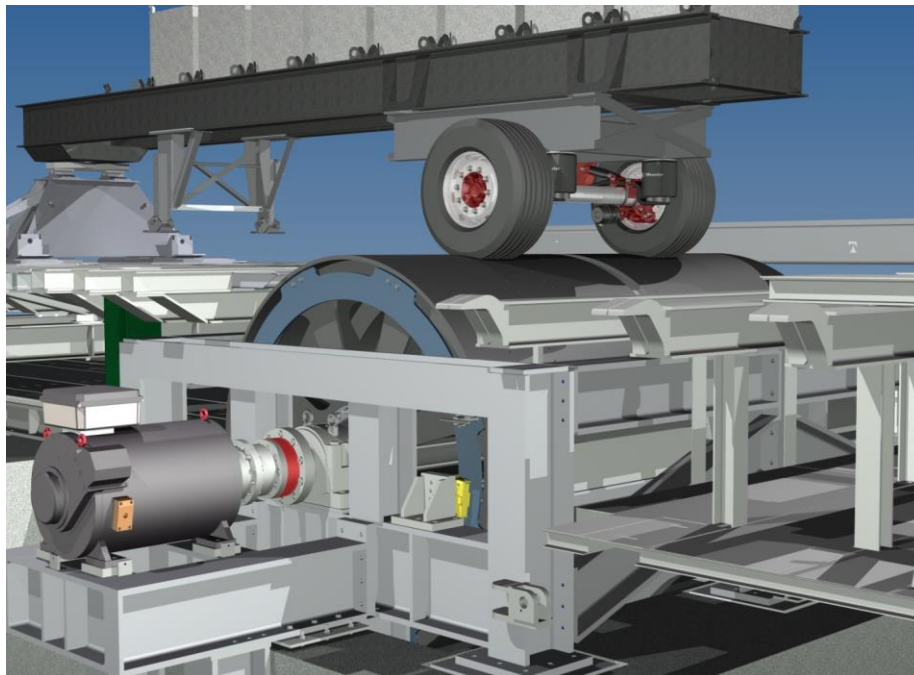


Figure 4.: The rollers, each with own drive, and 3 m diameter.

¹ Known hydraulic test benches do not include wheels and tyres, and are limited in frequency

The test bench is built up from a large 800-ton counterweight carried by 32 air bellows to ensure that no vibrations are transmitted to the environment. On the counterweight, a lorry is placed that can be moved in longitudinal direction by means of hydraulics to be able to install test vehicles of different lengths on the test bench. The lorry is also provided with a ram to be able to move the vehicle in the transverse direction during the tests.

At the rear of the counterweight, a heavy frame with two rollers is located, see figure 4. The rollers have a diameter of 3 m. Each roller has its own drive, and can therefore run independently of each other at the desired speed. Each roller has two rows of cleats in a specific configuration. A fully loaded test vehicle, with for example an axle load of 9 tons, can be placed on the test bench. A security device has been installed to ensure that, in case of a failure, the vehicle can fall on that protection so that the rollers will not be damaged. The vehicle position is checked with laser lights. As soon as the vehicle breaks out or moves too much downwards, this is noticed by the laser lights and the drive of the rollers will switch off and the brakes on the rollers are activated. Within a few rotations, the rollers have stopped.

4. Expected results: the use of the dynamometer

The construction of the test bench has been completed since 2015. Since then the test bench has been used by VDL Bus & Coach and by VDL Weweler, and it is available for third parties. As an example a number of buses was tested on the test bench to take measurements on electrically driven rear axles with hub motors.

VDL Weweler also started validating the test bench by taking measurements on a test trailer both on the test bench and on the DAF endurance test track. The DAF pavement track has always been a reference for VDL Weweler

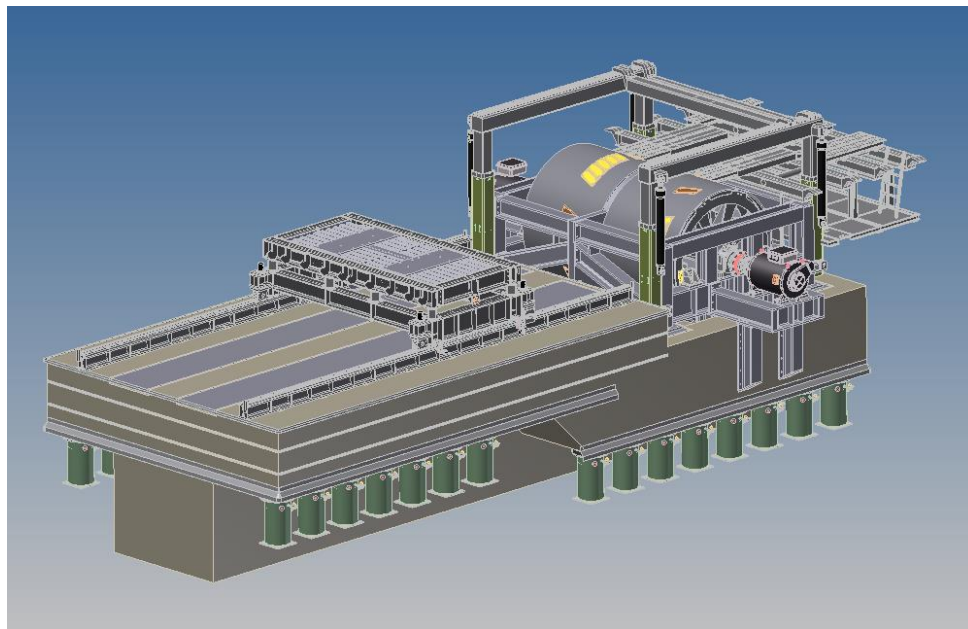


Figure 5.: Outline of the VDL Weweler Rolling Road

5. Conclusions and discussion.

An interesting test facility has been realized allowing efficient and effective in-door testing aiming endurance assessment and the response of heavy vehicle (components) under road induced vibrations. The results of the test bench have been compared with results from the DAF endurance test track. The result of the validation test is that testing on the dynamometer gives very good results and are comparable to the DAF track.

References

To get an idea of testing on the dynamometer there are some video's on YouTube available:

- <https://www.youtube.com/watch?v=A3Odicozp5c>

Or search on YouTube at: rollenbank brainport.nl