One of the Federal Highway Research Institute’s research goals is to eliminate or at least reduce environmental stress caused by road traffic. This includes minimization of noise generated by road traffic.

From a speed of about 30 km/h, an passenger car’s dominant noise source is the rolling noise of its tyres on the road surface. Accordingly, measures to minimize noise emissions by cars on roads bearing high-speed traffic must primarily address this source, i.e. tyre/pavement contact. There are essentially two main origins of such noise: Vibrations of the profile blocks and tyre carcass caused by pavement texture and aerodynamic streams in the tyre tread (air pumping effect). In the case of trucks, tyre/pavement noise dominates from a speed of about 60 km/h. Here as well the aim is to minimize noise generated by interaction between tyres and pavement texture.

To carry out examinations of this topic under laboratory conditions, a vehicle-pavement interaction facility was established at the Federal Highway Research Institute. Properties which can be tested here include the high speed and durability testing of tyres, tyre/pavement noise emission measurements and rolling resistance measurements of tyres, as well as the testing of the stability of pavements (rutting).

The test facility
The vehicle-pavement interaction test facility consists of a large, rotatable, half-open drum inside which cas- settes, which are filled with realistic road materials, can be installed. Pas- senger car and truck tyres as well can roll on this road surface.

The drum - with an internal diameter of 5.5 metres - is fixed to a central shaft by 12 spokes and is driven by a linear motor with a maximum speed of 280 km/h. The spokes are cove- red by sheet metal plates to avoid air turbulence and these are coated with sound-absorbing material. The central shaft is pivoted inside a frame structure with crossbeams.

Tests at the vehicle-pavement interaction test facility
This test facility can be used to scientifi- cally examinations of the following aspects:

- Tyre/pavement noise on novel, quiet pavement types and at bridge and carriageway transi- tions (expansion joints).
- Noise from passenger car and truck tyres on standardised road surfaces.
- High speed performance of pas- senger car and truck tyres.
- Rolling resistance of passenger car and truck tyres on different ty- pes of pavement.

Tyre/pavement noise can be measured in the near and far field. The tyre and pavement temperatures can be measured, too.

Roadway surfaces
Two different sets of roadway cassettes can be installed in the drum for the purpose of testing:

- 50-centimeter wide cassettes with a filling height of four centimetres.
- 85-centimeter wide cassettes with a filling height of eight centime- tres.

This permits various pavement structures comprising asphalt (dense or porous) or concrete to be installed in the test bench’s cassettes.

Three height-adjustable stations are present for mounting the wheels:

- Passenger car wheel station with steering angle adjustment (+/-15°).
- Passenger car wheel station without steering angle adjustment.
but with a device for rolling resistance measurements.

• Truck wheel station (without steering angle adjustment) with two different hubs for wheels sized between 17.5 inches and 22.5 inches (single and twin mode).

The wheel load can be adjusted pneumatically to a maximum value of 6,500 kg.

Laboratory results obtained on the test bench are compared with real-life values by the Federal Highway Research Institute’s experts. The findings are incorporated into national and international regulations.

Technical data
Drum’s internal diameter: 5.50 m
Drum’s weight: 32,000 kg
Drive: Linear motor, 350 kW
Top speed: 280 km/h
Number of cassettes: 18
Maximum wheel load: 6,500 kg

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