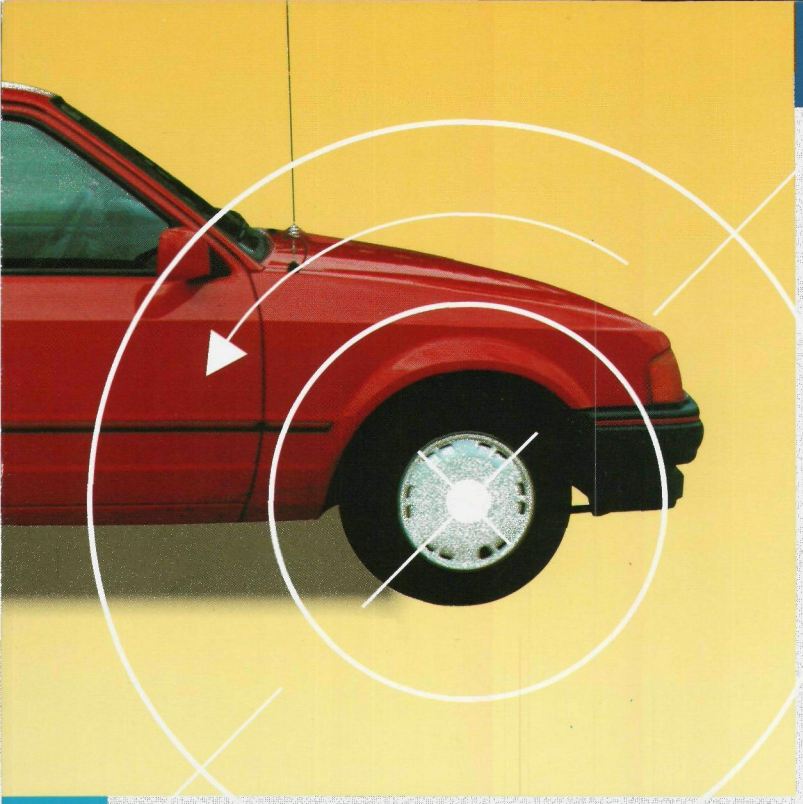

Delft Vehicle Research

Delft tyre test trailer

sets new standards in tyre research

The development of the Delft tyre test trailer by Delft Vehicle Research represents a major breakthrough in the vehicle dynamics world. The unit not only allows the horizontal performance characteristics of motorcycle and car tyres to be measured under a range of conditions at any location, but it is also equipped with sophisticated software to analyse the data collected. Use of the tyre test trailer will enable scientists and engineers to improve their understanding of the handling characteristics of cars and motorbikes and, ultimately, to design safer vehicles.

TNO

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Salient features of the tyre test trailer

The tyre test trailer is designed to be towed by a truck. It comprises:

- two central measuring towers;
- a control cabin at the front of the trailer housing the instrumentation and control units;
- ancillary equipment such as a pneumatic pressure system, a hydraulic pump etc.

Two measuring hubs are provided. The hub mounted on the left-hand tower is designed to be used with passenger car tyres and can carry loads of between 1000 and 10,000 N; the hub mounted on the right-hand tower is designed for testing motorcycle tyres and can apply vertical loads of between 500 and 5000 N. Both hubs are fully instrumented to measure the forces on tyres in the x, y and z directions, in addition to the self-aligning torque. Each hub is mounted in a special frame, which allows the slip and camber angles to be adjusted as required. A disk brake fitted to the left-hand tower can be used to apply a braking force to the test wheel.

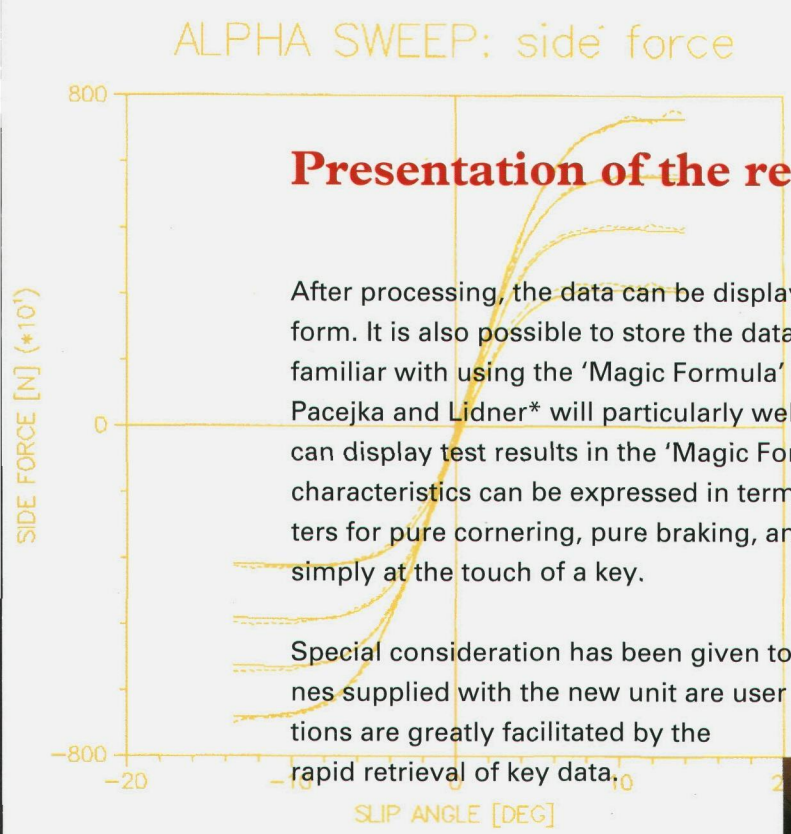
As a further refinement, 3000 litres of water can be carried in the truck for release onto the road surface immediately in front of the test wheel.

Test protocols

In its present configuration, the tyre test trailer can be used for:

- **alpha sweeps**, in which the slip angle is varied continuously over one complete cycle at a specific vertical load and camber angle. During the test, the lateral and vertical forces and self-aligning torque are recorded automatically. Tests can be repeated at various vertical loads and camber angles, if required;
- **kappa sweeps**, in which the degree of longitudinal slip is continuously varied by applying a braking force to the wheel. During such tests, the self-aligning torque and the lateral, longitudinal and vertical forces are recorded automatically. Test runs can be conducted at various vertical loads, camber angles and slip angles.

All measurements are normally carried out when the tyre under test is practically in a steady state condition. Special software has been developed to control the measuring and data acquisition systems. The data collected are stored on disk and processed in accordance with individual requirements.



Presentation of the results

After processing, the data can be displayed in both graphical and tabular form. It is also possible to store the data in files. Vehicle dynamics engineers familiar with using the 'Magic Formula' parameters proposed by Bakker, Pacejka and Lidner* will particularly welcome the fact that the unit's software can display test results in the 'Magic Formula' format. This means that tyre characteristics can be expressed in terms of specific 'Magic Formula' parameters for pure cornering, pure braking, and combined cornering and braking - simply at the touch of a key.

Special consideration has been given to ensuring that all the software routines supplied with the new unit are user friendly. Vehicle dynamics simulations are greatly facilitated by the rapid retrieval of key data.

* Bakker, E., Pacejka, H.B, Lidner, L.; A New Tire Model with an Application in Vehicle Dynamics Studies, SAE 890087.

Technical Specification

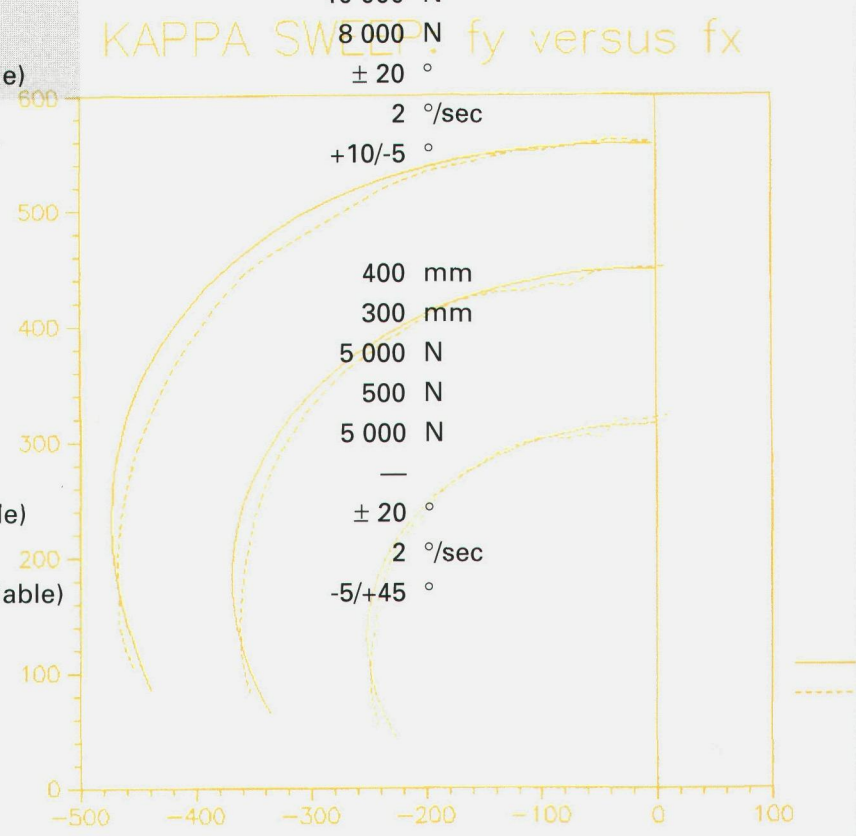
Maximum test velocity	110	km/h
Minimum test velocity	20	km/h
Maximum water flow	10	l/sec

Left-hand tower:

Maximum tyre radius	450	mm
Minimum loaded tyre radius	200	mm
Maximum vertical load	10 000	N
Minimum vertical load	1 000	N
Maximum lateral force	10 000	N
Maximum longitudinal force	8 000	N
Slip angles (continuously variable)	± 20	°
Slip angle velocity	2	°/sec
Camber angle	+10/-5	°

Right-hand tower:

Maximum tyre radius	400	mm
Minimum loaded tyre radius	300	mm
Maximum vertical load	5 000	N
Minimum vertical load	500	N
Maximum lateral force	5 000	N
Maximum longitudinal force	—	
Slip angles (continuously variable)	± 20	°
Slip angle velocity	2	°/sec
Camber angle (continuously variable)	-5/+45	°



Delft Vehicle Research

Delft Vehicle Research is a soon to be started collaborative venture between the Vehicle Research Laboratory of Delft University of Technology and the Vehicle Dynamics Department of the TNO Road-Vehicles Research Institute. It is particularly concerned with the development of vehicle simulation techniques and models, theoretical and experimental research into tyre behaviour, and the application of micro-electronics in vehicles.

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