

x-road curve

ADVANCED TESTING OF AUTONOMOUS DRIVING VEHICLES



New, revolutionary, unique

We expect autonomous driving on our roads no later than 2025. The test stands for the revolution in the End of Line area are already available. To achieve a considerable increase in efficiency during production, future vehicles will move autonomously and will be tested without any operator input needed.

In addition to the static calibration, dynamic function tests as for example the driving behaviour in typical traffic situations are to be performed in the future.

With the innovative multi-function test stand **x-road curve**, autonomous vehicles will be tested dynamically.

In addition to the conventional tests carried out on a roller test stand, vehicles can be tested on the x-road curve at high speed taking the vehicle steering into account.

Due to the technology of the x-road curve, an up to now unprecedented simulation of real driving situations on test stands will be possible. Furthermore, this unique technology can be integrated in all existing x-road test stands that have been installed.

The x-road curve offers unprecedented possibilities with the testing of semi-autonomous or autonomous driving vehicles and sets trendsetting impulses.

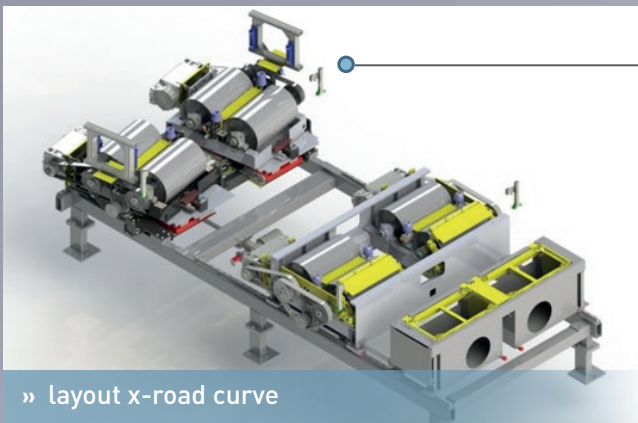
x-road curve - a revolutionary idea

On conventional roll test stands, vehicles can only drive straight ahead. In order to avoid a sidedrift of the vehicle and to not create the risk of it being ejected from the test stand, the driver has to constantly ensure that the vehicle remains in the centre of the test stand.

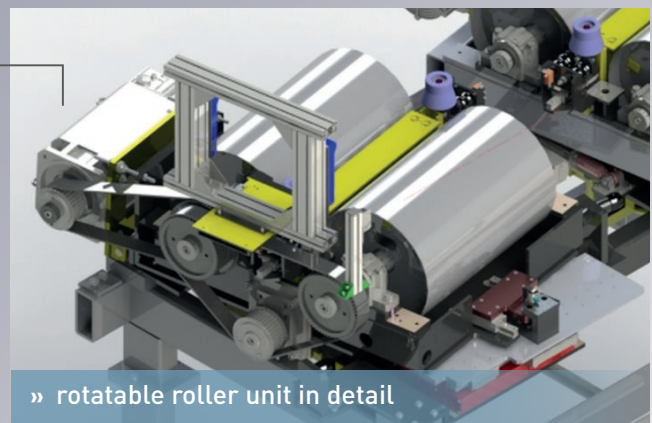
Thanks to the revolutionary test stand concept of x-road curve, it is possible to keep the vehicle in the centre of the test stand fully automatically - thus enabling a driverless vehicle testing - and to automatically carry out steering function tests. In order to enable this to be carried out, the front axle of a conventional roll test stand has been modified in such a way that the rotatable front wheel

support units (double rollers) can move according to the steering angle of the vehicle's front wheels. The movement and position of the rollers is detected and adapted via a contactless measurement system using a highly dynamic control system.

Therefore, the moving vehicle stays in the centre of the function test stand, independent of the steering wheel position, and various function tests of semi-autonomous and autonomous driving vehicles can be performed. Finally, the scope of the x-road curve is completed through integration of a simulation environment for integrated vehicle test via typical driving situations.



» layout x-road curve



» rotatable roller unit in detail

A unique test stand concept:

- » two separate roller units, each rotating around the vertical axis, to support the vehicle wheels of the front axle
- » two roller units to support the vehicle wheels of the rear axle
- » four vector-controlled drives for motor-driven and generator-based operation
- » contactless measurement system to detect the angle position of the vehicle wheels as well as the vehicle position
- » the automation software x-line for system control, motor management and interface handling

Unprecedented opportunities:

- » **roll/brake/ABS testing**
 - » general dynamic function testing
 - » testing of brake systems
 - » testing of sensors
- » **driverless testing**
 - » driverless testing of vehicles on roll and brake test stands without risking the vehicle being ejected out of the test stand
 - » controlling of driving direction and vehicle position via the steering function of the test stand
- » **testing vehicles that drive semi-autonomous/autonomous with a simulation environment**
 - » function testing with steering angle
 - » comparison of required and actual driving direction
 - » overtaking and evasive manoeuvres



Technical data x-road curve	
Testing speed	130 km/h with steering possibility 170 km/h without steering possibility
Max. steering angle	+/- 10° at the front axle
Typical traction force	3700 N / 6000 N dependent on the drive technology



* The photos or images of the assembly and testing systems in the flyer are not showing the complete installation. The requirements of the machinery directive (2006/42/EG) will only be met by other supplementary scope of supply or - on delivery of incomplete machines - those requirements must be fulfilled by the manufacturer of the (complete) machine. Flyer x-road curve, Version A