

**FKFS**

RESEARCH IN MOTION.

# Vehicle-in-the-loop Testing

Stuttgart Handling Roadway



**FKFS.de**



Stuttgart Handling Roadway - system overview



Stuttgart Handling Roadway - full vehicle testing

## 3D Vehicle Dynamics under Laboratory Conditions

### The Test Bench

The Stuttgart Handling Roadway (HRW) features four flat belt units that can be steered and moved in vertical direction. Together with the innovative center of gravity restraint system (CGR) this allows a most realistic reproduction of real world driving situations with simultaneous excitation in longitudinal, lateral and vertical direction. A robot driver provides all necessary control input and the highly customizable rig controller provides maximum flexibility to support a large variety of research and development tasks.

The system combines the advantages of full vehicle testing with maximum repeatability of the results and hazard free evaluation of potentially dangerous driving situations and corner cases. This helps saving time and cost within the development process.

## Applications

### Vehicle Dynamics Characterization & Benchmark

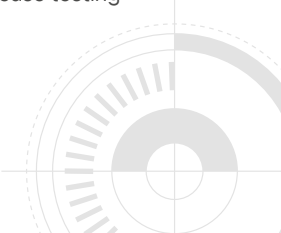
- Combined ride and handling assessments
- Open and closed loop driving maneuvers
- Suspension and subsystem characterization
- Support road and proving ground testing

### Active Chassis System Development & Validation

- Active suspension / steering system development
- Brake system and drivetrain development
- System interaction and degradation tests
- Component and sensor evaluation

### Function Development & ADAS Function Testing

- Vehicle-in-the-loop testing
- System integration, troubleshooting & diagnostics
- Pre-calibration of complex ECU functions
- Scenario based & limit operation testing
- Capability level evaluation & pre-release testing



# Technical Properties

## Moving-Belt Input Channel

|                              |                      |
|------------------------------|----------------------|
| Belt Speed                   | 0.5 – 220 km/h       |
| Peak Power / Cont. Power     | 220 kW / 140 kW      |
| Long. / Lat. / Vertical Load | 6 kN / 10 kN / 15 kN |
| Frequency Bandwidth          | >15 Hz               |

## Vertical Input Channel

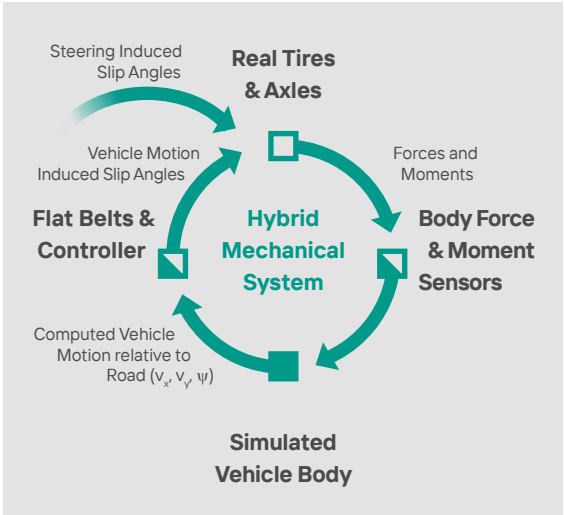
|                     |          |
|---------------------|----------|
| Acceleration        | 7 g      |
| Velocity            | 500 mm/s |
| Displacement        | ± 75 mm  |
| Frequency Bandwidth | 30 Hz    |

## Belt Steer Input Channel

|                     |                          |
|---------------------|--------------------------|
| Acceleration        | 4,000 deg/s <sup>2</sup> |
| Velocity            | 80 deg/s                 |
| Stroke              | ± 20 deg                 |
| Frequency Bandwidth | >15 Hz                   |



Stuttgart Handling Roadway – Robot Integration



Operating principle for lateral dynamics testing

# Contact



FKFS is an advanced engineering service provider of the international automotive industry and an independent research institution at the same time.

As an innovative partner, we offer our customers a wide range of services, from answering the most diverse questions to highly specialized custom solutions. In doing so, we benefit from our numerous test benches, our measuring, testing and simulation methods and our competent staff with excellent know-how.

# Making of

The Stuttgart Handling Roadway was launched by FKFS and Stuttgart University in 2019. It is currently a unique facility throughout the European automotive research landscape. It was designed to meet the challenges arising from drive train electrification, highly automated driving functions and increasing networking level.

The Handling Roadway was realized under the Major Research Instrumentation Programme as per Art. 91b GG funded by Stuttgart University, Baden-Württemberg Ministry of Science, Research and the Arts (MWK) and the German Research Foundation (DFG).

## Automotive Engineering 1 Vehicle Dynamics & Chassis Functions

**Dr.-Ing. Jens Neubeck**

T: +49 711 685 65701

[jens.neubeck@fkfs.de](mailto:jens.neubeck@fkfs.de)





## FKFS

Pfaffenwaldring 12  
70569 Stuttgart

T: +49 711 685 65888

F: +49 711 685 65710

info@fkfs.de

www.fkfs.de

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