Integrated Services
Test- and Validationcenter Wegberg-Wildenrath

Wegberg-Wildenrath, 2009
Industry Sector, Mobility Division
Every vehicle, every system, every technology – We meet that challenge

Test- and Validation center Wegberg-Wilderath
Welcome to the worlds most modern state-of-the-art Test- and Validationcenter in Wegberg-Wildenrath

Test- and Validationcenter Wegberg-Wildenrath: Facts and figures

- Inaugurated in January 1997
- Site area: 35 hectares of which 21,300 m³ are built-up
- Tracks: approximately 28 km in standard gauge, partly in meter gauge
- Power supply for all standard rail systems worldwide
- Employees (average):
  - Siemens: 250
  - Non-Siemens (consortiums, suppliers): 100
- Investment: 105 million Euro
- Status of having a branch line in accordance with BOA regulation of the state railway laws since 1997
- Status of being a public rail company for freight transport (member of VDV) since 1999
We are able to do complete tests for rolling stock, systems or components

One test center: Rolling stock, systems, components

**Rolling stock**
Optimization, commissioning and approval, type and routine testing and retrofitting including re-commissioning e.g. special tests of traction, brake and other on-board systems; TSI Noise, safety against derailment, ETCS level 1 and 2, ATB, PZB

**Systems**
System integration of vehicle and infrastructure as well as special tests for research institutes e.g. installation of automatic train control centre for Bangkok; measurement of railroad network behavior with several locomotives

**Components**
Testing of components for rolling stock vehicles under real conditions or on an experimental vehicle e.g. new traction systems including converter, motor and cooling unit, radar sensor, special wheel sensors
We offer an excellent infrastructure with 28 km of track for tests typically needed for your railways

Test ovals / tracks for all tests

<table>
<thead>
<tr>
<th>Test infrastructure</th>
</tr>
</thead>
</table>

| Test oval T1       | Length 6 082 m | Max. speed 160 km/h |
| Test oval T2       | Length 2 485 m | Max. speed 100 km/h |
| Test track T3      | Length 1 500 m | Max. speed 80 km/h  |
| Test track T4      | Length 553 m  | Radii 50/25/15 m    |
| Test track T5      | Length 410 m  | Max. gradient 40/70 ‰ |
The Test- and Validationcenter offers a variety of solutions for almost every system

Overview test ovals / tracks: Gauges, voltage systems, catenary or 3rd rail

<table>
<thead>
<tr>
<th>Technical data</th>
<th>Test area</th>
<th>Test oval T1</th>
<th>Test oval T2</th>
<th>Test track T3</th>
<th>Test track T4</th>
<th>Test track T5</th>
<th>Train formation buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure clearance gauge</td>
<td>1 SM/DR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Track gauge 1 435 mm</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Track gauge 1 000 mm</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
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<td></td>
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<tr>
<td>Axle load 22.5 t</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Axle load 26.0 t</td>
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<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Contact wire</td>
<td></td>
<td></td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third rail</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
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<td></td>
<td></td>
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<tr>
<td>Traction supply, selectable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 kV/16.7Hz</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 kV/50 Hz</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 kV/25 Hz</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 kV/60 Hz</td>
<td></td>
<td>✔️</td>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>= 750 V</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>= 400–2 000 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>= 2 000–4 000 V</td>
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</tbody>
</table>

* UK-type third rail
The Test- and Validationcenter offers power supply for all standard rail systems worldwide

Power supply in Wegberg Wildenrath

**Schematic diagram**

- **Supply from WLK utility**
- **Test center traction**
- **Converter 1**
- **Converter 2**
- **Transformer**
- **Rectifiers**
- **Trackside switchgear**

**Power supply**

**Power supply (grid)**
- \( U = 20 \text{ kV/50 Hz} \)
- \( S_{\text{max}} = 15 \text{ MVA} \)

**Building supply**
- \( U = 400/230 \text{ V/50 Hz} \)
- \( S_{\text{max}} = 1.2 \text{ MVA} \)

**Static converters 2 units**
- \( P_{\text{max}} = 2 \times 7.5 \text{ MW} \)
- \( U = 15 \text{ kV/16.7 Hz und 25 kV/50 Hz} \)
- \( U = 12 \text{ kV/25 Hz und 25 kV/60 Hz} \)
- Single-phase AC transformer 25 kV 5 MW

**Rectifiers 3 units**
- \( I_{\text{max}} = 4,000 \text{ A per unit} \)
- \( U_1 = \pm 750 \text{ V 12 pulse} \)
- \( U_2 = \pm 400 \text{ V ... 4,000 V 6/12 pulse} \)
- \( U_3 = \pm 400 \text{ V ... 1,800 V 6 pulse} \)

**Trackside switchgear**
- 5 incoming feeders
- 4 busbar systems
- 48 two-pole motor disconnectors
- 19 section feeders
A new 25 kV transformer completes the test centers’ power supply systems

25 kV transformer

<table>
<thead>
<tr>
<th>Technical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Dry-type transformer with Steinmetz circuit</td>
</tr>
<tr>
<td>- Infeed from the national grid with 20 kV (3 phase)</td>
</tr>
<tr>
<td>- Voltages adjustable in 10 stages from 22.5 kV to 27.5 kV</td>
</tr>
<tr>
<td>- Feedback of braking energy into the national grid</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 5 MVA (continuous)</td>
</tr>
<tr>
<td>- 10 MVA (10 min)</td>
</tr>
</tbody>
</table>
We can simulate a realistic rail operation on approximately 28 km of track

Test ovals / tracks for all tests

- Preparation area
- Large test oval – T1
- Small test oval – T2
- Straight test track - T3
- Test track with curves - T4
- Test track with gradient - T5

We can simulate a realistic rail operation on approximately 28 km of track.
Independent committees have proven Siemens’ competence for high quality testing

Certification, accreditation, approval and associated partner

**Facts & Figures**

**Certificates**
- DIN ISO 9001
- DIN ISO 14001
- OHSAS 18001
- DIN ISO 17020
- DIN ISO 17025

**Accredited by**
- DAP (ILAC) DIN EN ISO/IEC 17025
- DAP DIN EN ISO/IEC 17020

**Recognition by**
- German Federal Railway Authority
  Test facility for railway systems
- EISENBAHN-CERT
  Notified Body Interoperability Rail Systems

**In accordance to**
- § 33 EBO
  Experts for systems that require supervision
The Test- and Validationcenter offers independent testing facilities for rolling stock and infrastructure.

Test- and Validationcenter: Mechanical and electrical test expertise

Certifications and Accreditations

EN ISO 9001
EN ISO 14001
EN ISO/IEC 17025
EN ISO/IEC 17020
EN ISO/IEC 17020
EN ISO 18001

Test- and Validationcenter

Clustered Mobility resources
Testing
- developing
- planning
- executing

Infrastructure of test center
Inspection
- establishing

QM system Validation Center PCW
Homologation & validation
- coordinating
Make use of an excellent infrastructure for commissioning and working on the vehicle

Infrastructure: Commissioning and working under, at the side and on the roof of vehicles
We offer the possibility to perform static tests on specific testing facilities

First-class infrastructure for static tests

<table>
<thead>
<tr>
<th>Static tests</th>
</tr>
</thead>
</table>

**Mechanical part**
- Geometrical vehicle test
- Stationary bogie tests  
  (ease of movement, rotation torques)
- Discharge tests
- Tilting coefficient and axis of rolling
- Static testing of air brake
- Loading and load-status tests
- Reciprocal sound radiation (attenuation of air-borne noise)
- Measurement of air- and structure-borne noise
- Stationary thermal measurements
- Measurement of lighting and air systems
- Leakage test, exposure to rain

**Electrical part**
- Insulation test
- EMC measurement
- Measurements on on-board power supplies
- Testing of safety and information systems
- Testing of diagnostic systems
- Measurements on HVAC systems
- Testing of grounding and protection measures
- Testing of auxiliaries (direction of rotation, starting)
We offer the possibility to perform long-term tests without interruption

First-class infrastructure for dynamic tests

<table>
<thead>
<tr>
<th>Dynamic tests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical part</strong></td>
</tr>
<tr>
<td>- Braking power tests, e.g. to UIC 544</td>
</tr>
<tr>
<td>- Determination of natural frequencies, vibration tests</td>
</tr>
<tr>
<td>- Testing of rolling resistance characteristics and safety</td>
</tr>
<tr>
<td>- Measurement of mechanical stress</td>
</tr>
<tr>
<td>- Continuous thermal tests on electrical and mechanical components</td>
</tr>
<tr>
<td>- Dynamic traction trials</td>
</tr>
<tr>
<td>- Measurement of noise levels for vehicle interior and passage</td>
</tr>
<tr>
<td>- Reference track in accordance with the Technical Specifications for Interoperability (TSI)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical part</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Testing of performance and vehicle dynamics,</td>
</tr>
<tr>
<td>- Testing of traction system and electric brake</td>
</tr>
<tr>
<td>- Measurement of interference (system perturbations, track circuit, psophometry, radio interference)</td>
</tr>
<tr>
<td>- Processes involved in transitions and system changes</td>
</tr>
<tr>
<td>- System trials with on-board/traction power supply or on-board/control and safety systems</td>
</tr>
<tr>
<td>- Continuous thermal tests</td>
</tr>
</tbody>
</table>
Testing for real-world applications and extreme cases with a vast range of train control systems

Train control systems: For transition tests

**Technical Data**
- German system PZB
- ETCS level 1
  (balises programmable with SCMT/ZUB121)
- Line side electronic unit
- ETCS level 2 with GSM-R
- ATB system
- Track circuit inductor
Measurement of wheel-and-axle rail forces are possible on 8 variable weighing elements

Weighing device: Measurement of wheel-and-axle rail forces; z measurement tests

### Technical Data

- **Length**: 52 m
- **Number of weighing elements**: 8
- **Distance of the weighing elements**: variable
- **Lifting power of each axle (wheel pair)**: 30 t
- **Measuring range of each axle**: 1 – 180 kN
- **Data resolution**: 50 N
Using the special turn-tilt table to test vertical curves without moving the vehicle

Turn-tilt table: Clearance tests and measurement of bogie rotational resistance

### Technical Data

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>6600 mm</td>
</tr>
<tr>
<td>Track gauges</td>
<td>1435 mm and 1000 mm</td>
</tr>
<tr>
<td>Rotating angle around the z axis</td>
<td>±15°</td>
</tr>
<tr>
<td>Rotating speed</td>
<td>0.1 – 1.5 °/s</td>
</tr>
<tr>
<td>Measuring range torque</td>
<td>150 kNm</td>
</tr>
<tr>
<td>Rotating angle around the y axis</td>
<td>4.5°</td>
</tr>
</tbody>
</table>
Using the special curved test track to test vertical curves with moving the vehicle

Curved test track: Measurement according to DIN EN 14363:2005 (wheel rail forces Q,Y)

<table>
<thead>
<tr>
<th>Technical Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Radius of curvature</td>
<td>150 m</td>
</tr>
<tr>
<td>Track gauge</td>
<td>1440 mm</td>
</tr>
<tr>
<td>Cant</td>
<td>0 mm</td>
</tr>
<tr>
<td>Length of curvature</td>
<td>49.7 m</td>
</tr>
</tbody>
</table>

Evaluation of safety of vehicles against derailment
According to DIN EN 14363:2005
Testing the noise emissions of vehicles on a special noise test track

Noise test track according TSI Noise, DIN EN ISO 3095:2005

<table>
<thead>
<tr>
<th>Noise test track</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical Data</strong></td>
</tr>
<tr>
<td>▪ Length of grinded track section: 250 m</td>
</tr>
<tr>
<td>▪ Size of free field test site: 80 m x 40 m</td>
</tr>
<tr>
<td>▪ Ground level from top of rail: 0 m to -1 m</td>
</tr>
<tr>
<td>▪ Maximum speed: 160 km/h</td>
</tr>
</tbody>
</table>

Measurement of noise emitted by rail vehicles

▫ Outdoor measurement of vehicle passage, accelerating and braking as well as at standstill according to ISO 3095 and TSI Noise
▫ Measurement inside the running vehicle and at standstill according to ISO 3381 and TSI Noise
Testing vehicles for all of Europe on only 6 km of track

Betuwe route: Large test oval (ATB – ETCS – PZB)

Automatic train control systems

Test oval T1
Length 6 082 m
Max. speed 160 km/h
Only checked quality leaves the Siemens Test- and Validationcenter in Wegberg-Wildenrath

Customers who relied on the Test- and Validationcenter in Wegberg-Wildenrath

A. Desiro ML
   Mittelrheinbahn

B. Munich Underground
   MVV

C. Combino
   Budapest

D. Desiro UK
   First TransPennine
   West Midland

E. ICE T® electric trainset
   German Rail (DB AG)

F. Class 189
   German Rail (DB AG)
Good to know that everything will work correctly in revenue service

Test- and Validation center for rail systems: Wegberg-Wildenrath

Wegberg-Wildenrath Test Center

**Our competence for your success**

- Drastic reduction of commissioning time at customer’s premises
- Remarkable reduction of failures during operation
- Safety and reliability from the beginning
- Type and routine testing without interruption
- Short innovation loop through short-notice testing
- Avoiding failures in advance
- Testing of railway systems before they exist in reality
- Measurement of special network behavior to find solutions for inexplicable incidents
- Nearly real life testing for supplier of railway components
The greater the challenge, the better we get –
We keep rail systems running