Global Competence Center for Bogies Graz

Bogies from Graz – Yesterday, today, tomorrow – Committed to tradition
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**Business mission**
Global Competence Center and fully integrated location for bogies and pantographs
IN, EN, MF, PM, QM, PN, CS, P

**Highlights**
- Highly automated value chain
- ~ 55,000 bogies delivered since 1998
- 99% delivery reliability

**Figures**
30. Sept. 2019
- Order intake FY19: 647’
- Revenue FY19: 407’
- Employees incl. CS: 1105
- Bogies FY19: 1940

**Products**
Bogies, bogie components, wheel sets, pantographs, customer service for these components

**Customers**
internal/external

**Business**
- Global multi-project business
- Implementation of 50 – 60 projects/year
- Quantity 1 to ~2,000 units/project

Bogies Graz is a “one-stop shop” for bogies within Mobility
Reliable and competitive engineering partner and stable in-house supplier

Our business, bogies...

Research, development, manufacturing and support of marketing bogies and their subsystems (e.g. bogie brake system) and bogie technologies (e.g. bogie diagnostics and monitoring, wheelset) globally

... have significant influence on ...

- Driving safety (stability, derailment safety)
- Driving comfort
- Noise emission and compliance with clearance
- Life cycle costs (LCC>40% for the bogie)

... and face the competition alongside the PUs

- With regard to competitive prices and flexibility
- Adapting the portfolio to strategic requirements together with the PUs
- The competition likewise has bogie in-house competence
The BG Global Competence Center is embedded in a strong region

### Siemens in Styria

**Graz** Mobility Production/engineering/service location

- **1854** Commencement of wagon construction by Johann Weitzer in Graz (historical heart of today’s competence center for bogies)

**Weiz** SAGÖ Production/engineering/service location

- **1892** Founding of the Franz Pichler factory in Weiz (historical heart of today’s transformer plant)

**Graz** SAGÖ regional office

- **1900** first office of Siemens and Schuckert at Herrengasse in Graz

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### Mobility Graz Project highlights FY 2017/2018

- A new logistics hall went into operation
- Successful implementation of the new steel construction – and logistics concept
- Successfully obtained authorization for bogies for Cityjet, Thameslink and Vectron Finland
- Successful integration of pantograph production
- Recognition for “Inventor of the year 2017” following the last time in 2007 in the category Open Innovation
- Numerous patents for the next bogie generation in the Mireo and Velaro Novo
- 99% delivery reliability on installation deadline
- Innovative lightweight frame enables a weight reduction of >40%
- The 1,000th Vectron bogie delivered on schedule
- Successful commissioning of 2 innovative drilling machines – Motion Control implementation 2020
- Successful product launches in implemented Sacramento (MUST, AAF, San Francisco)
- Implementation of the diagnostics and monitoring digital maintenance concept in the large-scale project RRX
- Successfully established the FIT & SAFE health and safety program

### Social responsibility

- Training of around 60 apprentices per year on average
- Partnership with the Graz University of Technology, one of the nine top universities worldwide, as part of the “Siemens Center of Knowledge Interchange” program for innovation management, talent development and technology transfer
- Siemens supports bringing “Light into the Darkness” each year

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**Styria**

- **16,400km²** of surface area
- **1,237,298** Population
- **€44,283m** Regional GDP 2016

**Siemens figures**

- **€150m** purchasing volume
- **€933m** business volume
- **2,414** employees

**Siemens Mobility Austria GmbH**

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The development of mobility in Austria
1854 – 2019: 165 years mobility expertise

SGP – main supplier of ÖBB (Austrian Federal Railway) for finished vehicles
SGP 300, SGP 400

1988 – 1992

1941 Simmering-Graz-Pauker AG

1854 J. Weitzer wagon construction

1890 Factory

1909 Graz ship diesel engine, 150 PS

1934 Machine and wagon construction Schmid

1958 Acquisition of the Floridsdorf locomotive factory (Lofak)

1993 1996

1993 – 1996
Siemens VT bundles the competencies of vehicle engineering

1996 – 1999
Graz becomes the Competence Center for bogies of Siemens AG

2000 – 2002
Innovative bogie concepts
Desiro UK and ICE 3

2005 – 2006
BG becomes the world headquarters for bogies

2007 and 2017

2005 Velaro CN, 3rd gen.

2009 Integration into Siemens AG Austria

2004 Company name change to Siemens Transportation Systems

2001 Siemens acquires 26% share and achieves 100% ownership by 2001

1992 Siemens acquires 26% share and achieves 100% ownership by 2001

2001 All rolling stock activities consolidated in Siemens SGP Verkehrstechnik

2004 Separation of SGP AG into SGP VA Energie- und Umwelttechnik and SGP Verkehrstechnik (leading company of AI)

1989

1958 Acquisition of the Floridsdorf locomotive factory (Lofak)

1941 Simmering-Graz-Pauker AG

1934 Machine and wagon construction Schmid

1929 J. Weitzer wagon construction

1890 Factory

1909 Graz ship diesel engine, 150 PS

1934 Machine and wagon construction Schmid

1909 Graz ship diesel engine, 150 PS

1934 Machine and wagon construction Schmid

1992 Siemens acquires 26% share and achieves 100% ownership by 2001
The megatrends of the mobility industry serve as the basis of our driving force behind the BG areas of innovations.
Global Competence Center for Bogies Graz

- One of the world’s largest sites for the development and production of bogies
- Around 55,000 bogies have been produced since 1998
- Approximately €120m invested in the site since 1998
- 240 highly-qualified engineers
- Capacity for approx. 3,500 bogies per year
- Highest level of automation
- 60 apprentices
- Operational experience is the key to innovation: >100bn kilometers in operation

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240 highly-qualified engineers
Highest level of automation
Local and international supplier management
Innovations, platforms

Global multi-project business
Excellent processes, full certification
"Customer Service is an attitude not a department". We keep the world running
The best quality ensures the best contact

Employees

MO RS SC BG | Bogies Graz
Global Competence Center for Bogies Graz
“one-stop shop” for bogies

<table>
<thead>
<tr>
<th>Management EN, IN, PM, P, QM, CS, PN</th>
<th>Logistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Production</td>
<td>Test facility</td>
</tr>
<tr>
<td>Assembly</td>
<td>RASMO wheelset assembly</td>
</tr>
<tr>
<td>Painting plant</td>
<td>Bogie Repair und Service Center</td>
</tr>
<tr>
<td>Mechanical production</td>
<td>Pantograph production</td>
</tr>
</tbody>
</table>
The world of bogies

Global Competence Center Graz

Development
- System
- Structures
- Components
- Simulation
- Integration
- Dynamics
- Digitalization
- Life cycle costs (LCC)

R&D
Basic research, platform development, maintenance

PPM

Tests

Production

Bidding, order and project management

Ideas

Universities and research centers

Customer requirements
- Locomotives
- High-speed and intercity trains
- Commuter trains
- Metros
- Trams and light rail vehicles
- Passenger railcar

Customer product definition

Global market

Customer end product
- Locomotives
- High-speed and intercity trains
- Commuter trains
- Metros
- Trams and light rail vehicles
- Passenger railcar

Operator

BG customer service
- Repair
- Spare parts
- Maintenance
- Retrofitting

Customer feedback

Trends/Competitors

Not restricted © Siemens Mobility Austria GmbH

Page 12 October 2019 MO RS SC BG | Bogies Graz
Graz is a global supplier of bogies and components for modern rail transport

- High speed and intercity trains
- Regional and commuter trains, passenger railcars
- Metros
- Trams and light rail vehicles, VAL
- Locomotives
- Pantographs

Locomotives

High speed and intercity trains

Regional and commuter trains, passenger railcars

Metros

Trams and light rail vehicles, VAL

Locomotives

Pantographs
The bogie product portfolio at a glance

SFxxx: Bogie platform

Speed (km/h)

Axle load (ton)

- Trams and light rail vehicles
- Regional
- Passenger railcars
- High speed
- Metro
- Locomotives
# Formula 1 by rail – High speed bogies for maximum comfort, reliability and safety

**High speed and intercity**

<table>
<thead>
<tr>
<th>Distance traveled</th>
<th>30 billion km = 200x the distance from earth to sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>360km/h</td>
</tr>
<tr>
<td>Number of bogies</td>
<td>&gt;6,000</td>
</tr>
<tr>
<td>Availability</td>
<td>&gt;99%, general inspection every 3.3 million km</td>
</tr>
<tr>
<td>Reliability</td>
<td>Only 10 minute delay per 1 million km</td>
</tr>
<tr>
<td>Energy efficiency</td>
<td>0.33 liter fuel/100 km and passenger</td>
</tr>
<tr>
<td>CO₂ emissions</td>
<td>Up to -80% compared to passenger car</td>
</tr>
<tr>
<td>Vehicles</td>
<td>Velaro, ICE 4, ICE 3</td>
</tr>
<tr>
<td>Bogies</td>
<td>SF500</td>
</tr>
</tbody>
</table>

![World map showing regions of operation](文物)

**Regions of operation**
- Europe
- South America
- Asia
- North America
- Africa
- Australia
The carrying capacity of metro systems is unrivaled

**Metros**

**Speed**
80 – 120km/h

**Number of bogies**
>9,000

**Availability**
>99%, general inspection every 1 million km

**Requirements**
Inhomogeneous requirements
(axle load, clearance, platform height, …)

**Carrying capacity**
Up to 75,000 passengers/hour
(every 2 minutes up to 2,500 passengers)

**Vehicles**
Inspiro Midcap, Inspiro Highcap

**Bogies**
SF1000, SF3000
Regional trains, commuter trains, passenger railcars

Proven technology that is flexibly configurable to the various needs of our customers in regional transport

Distance traveled
20 billion km = 500,000 times around the earth

Speed
120 – 160km/h

Number of bogies
• >10,000
• Train and bogie platforms allow for configuration according to customer requirements (e.g. length, drive power, etc.)

Availability
>99%, general inspection every 1.5m

Energy efficiency
Use of conceptional light weight construction and new materials to reduce mass and thus increase transport capacities

Vehicles
ÖBB Cityjet, Thameslink, Mireo

Bogies
SF6500, SF7000, SF7500
Trams and light rail vehicles contribute substantially to alleviating traffic congestion in city centers

**Trams and light rail vehicles, VAL**

### Speed
70 – 120 km/h

### Number of bogies
- Approximately 5,000
- High degree of standardization despite varying track widths

### Vehicles
Different vehicle concepts

### Floor height
Low-floor tram 350mm
up to high-floor tram 1,000mm

### Vehicles
Avenio, Avenio M, S70, S200

### Bogies
SF35, SF30, SF40, SF70

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**America**
- North America
- South America

**Europe**

**Asia**

**Africa**

**Australia**
With our locomotive bogie, we cover the entire spectrum ranging from freight transport to intercity transport.

**Locomotives**

- **Speed**
  80 – 230km/h

- **Drive power**
  2,000 – 6,400kW

- **Maximum axle load**
  30 tons

- **Number of bogies**
  Approximately 5,000

- **Tractive force at starting**
  Up to 450kN

- **Requirements**
  Extensive standardization and modularization despite country-specific requirements (train protection)

- **Vehicles**
  Vectron, Amtrak Cities Sprinter, Charger

- **Bogies**
  SF4, SF3
BG PN is an internal partner for pantograph development and assembly is an integral part of the Mobility product portfolio.

The quality of the contact is essential for frictionless and efficient operation!

**Today ...**

- Mireo

**Tomorrow has started ...**

- Velaro
- Novo

**The future to be developed**

- 3. Rail pantographs
- E-highway
- Electric bus
  - Roof pantographs
  - Inverted pantographs

- Pantograph test facility

- Isolation directly in the pantograph by using GRP components
- Extremely low construction height
- First-time use of a pantograph control to precisely regulate pressure
Close working relationships and partnerships
Occupational safety and compliance are non-negotiable

The safety of our employees and compliance are the foundation of our business and are non-negotiable

BG management
In line with our Siemens production system, our health program “fit&safe@BG” is based on 4 key pillars

1 | Prevention and medical care
The aim of this pillar is to maintain, improve and strengthen the psychological well-being of our employees on site. Responsibility: AMED, medical personnel

2 | Occupational safety and healthy working environment
The aim of this pillar is optimized healthy and safe working conditions in each working environment beyond the legal requirements. Responsibility: Safety professionals, safety officers and AMED

3 | Psychological well-being and mental strength
The aim of this pillar is an optimized working atmosphere to improve the psychological well-being of our employees

4 | Fitness, exercise and healthy nutrition
The aim of this pillar is to increase our employees’ fitness by offering activities to promote nutrition and exercise for our employees

- Long-term involvement in the safety and health culture of the company
- Promote health awareness
- Improve communication
- Increase the attractiveness of the working environment

“He who knows his destination will find his way”
Laozi
Safety information for visitors

Please follow the instructions of your contact person.

Please stay on marked routes and stay with the group.

If you wear a pacemaker you should necessarily inform your contact person.

Pay attention to fork lift trucks operating and truck traffic on the entire factory site.

Pay attention to audible signals (continuous sounds). Leave the building through emergency exits and make your way to the assembly point.

Do not stay or stand under a suspended load.

Please use the personal safety equipment that is provided.

In certain areas wearing ear protection is compulsory.

Keep sufficient distance from running machines, grinding or welding works.

Do not watch the arc lights.

Smoking and taking photographs is strictly forbidden.
Thank for your attention

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