

MOBILITY FOR SOUTH AFRICA



The Climate is Right for Trains

BOMBARDIER
the evolution of mobility





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CREATING BETTER WAYS TO MOVE SOUTH AFRICA

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It is an exciting time to be part of the rail sector in South Africa. Investment in the development of the South African rail network is set to reach an all time high and rail projects are being prioritized at a national and local level. This underlines what we at Bombardier have long believed – Rail is good for the economy and it's good for the environment. What's more, it's driven by popular demand – today's travelers are choosing rail.

We owe it to these passengers to provide the best train technology the world has to offer, with equipment and services that make their journey experience a better one. At Bombardier, it is our mission to provide trains that prioritise comfort and accessibility for today's passengers and transport systems that improve connectivity by bringing people to their destinations more quickly and reliably. And in all our products and equipment you will see tangible evidence of our commitment to delivering more sustainable transport.

Bombardier Transportation has been established in South Africa since 1995, supporting the local industry with rolling stock, rail control solutions, product maintenance and services, as well as locomotive and commuter train refurbishment programs.

Our Long-term partnerships with major customers have repeatedly shown benefit in terms of product development for specific applications, local support to maintain the high reliability for which we are known and confident on-time delivery to enable clear business planning.

Bombardier Transportation South Africa aims to invest in local manufacturing capacity, training and improving the skills development of local employees, while working with local suppliers to achieve the same objectives.

While rail passengers have higher expectations from their trains, transport operators and asset owners also have more challenging requirements for the performance of their trains. We welcome this incentive to continually push new boundaries in the innovative design of our products and evolution of our services.

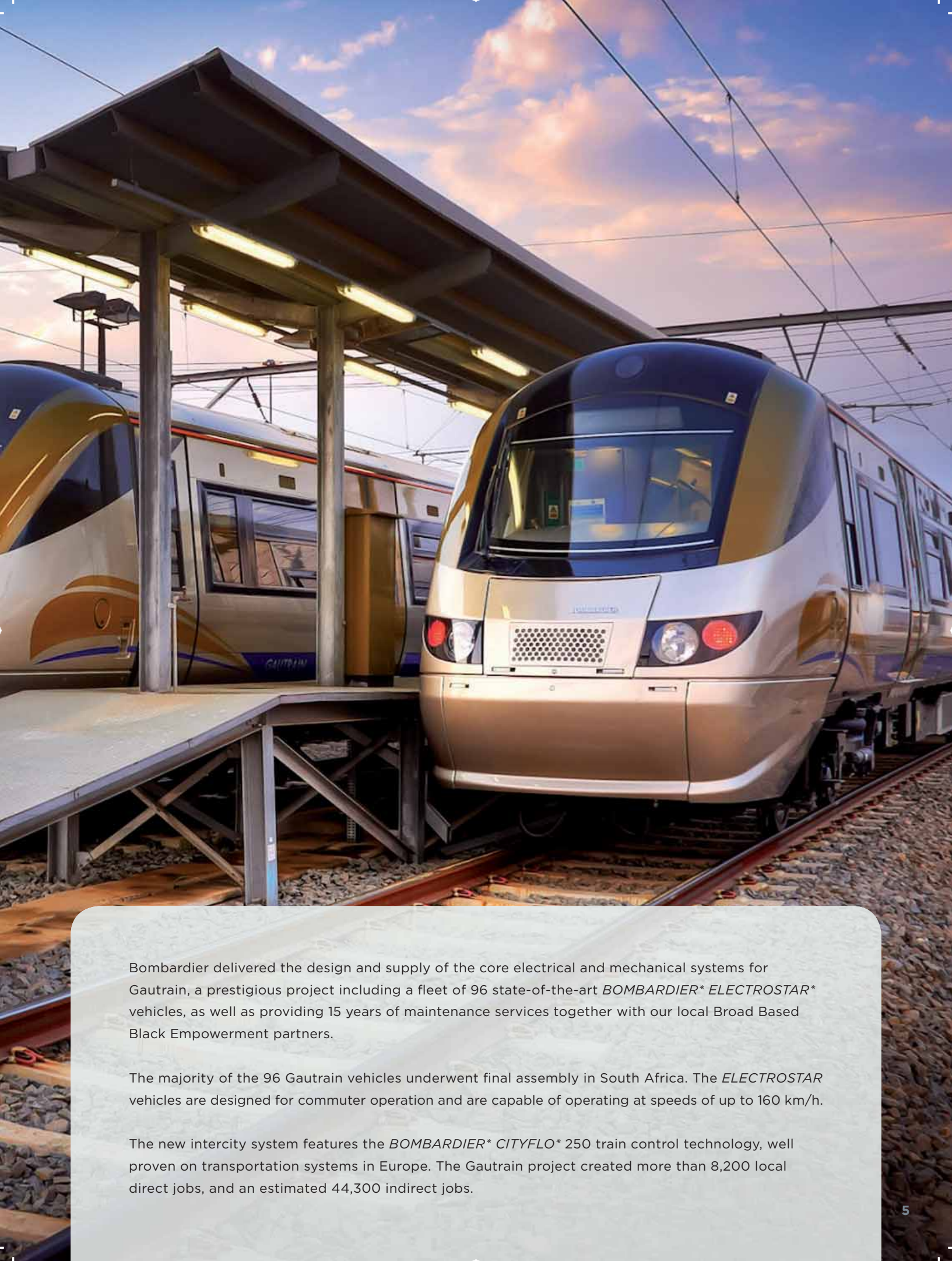
In this publication we would like to share some of the projects we have been a proud part of in South Africa and would like to introduce our transportation solutions that drive the evolution of mobility and make a difference to the communities they serve.

A photograph of two high-speed trains, likely Shintaro 200s, on a track. The trains are white with blue and yellow accents. They are positioned on tracks with overhead power lines. The sky is a mix of blue and orange, suggesting sunset or sunrise. The train on the left has the number 301 014 visible on its side.

AN AFRICAN DREAM

Gautrain Rapid Rail Link

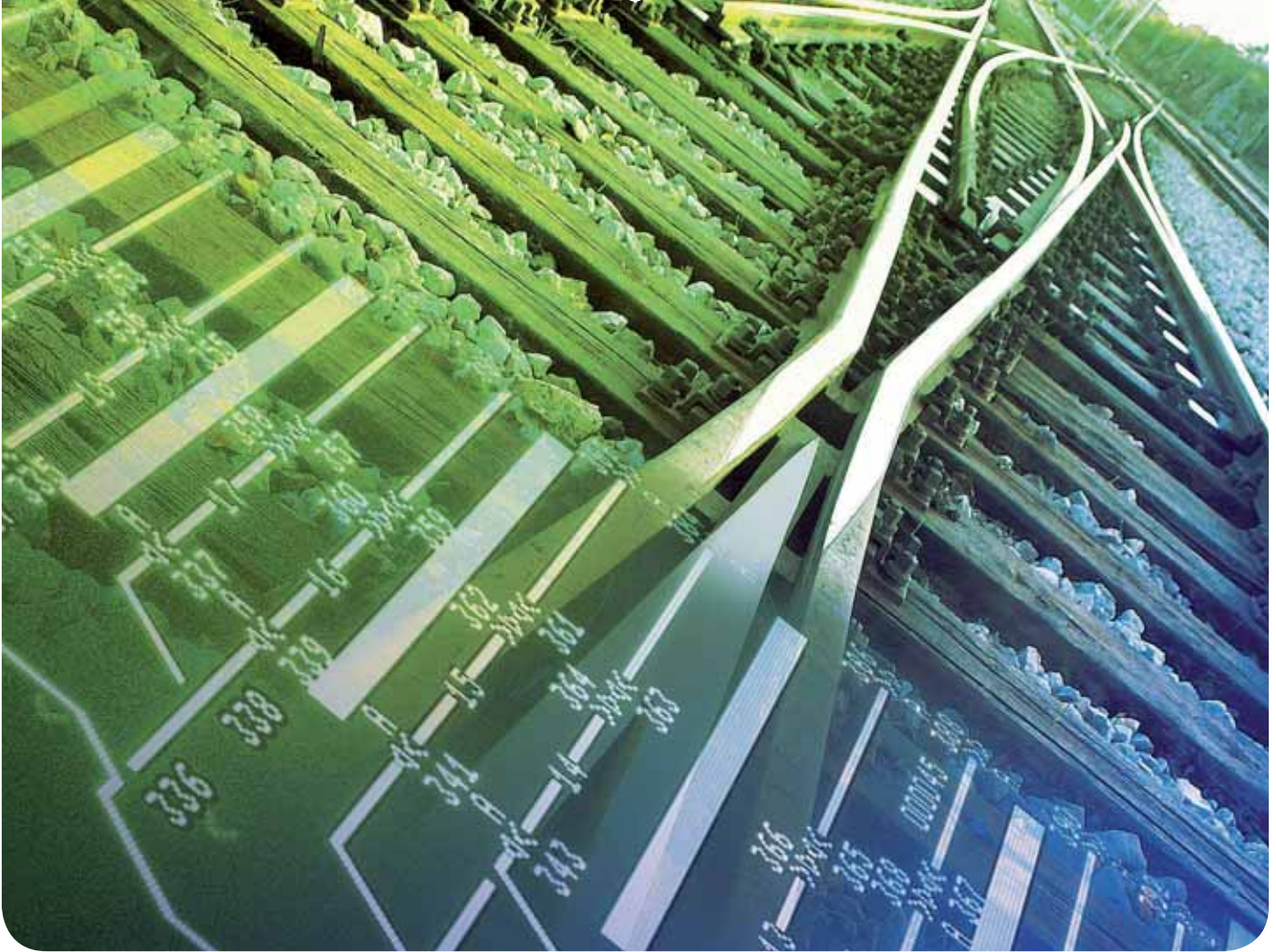
Bombardier Transportation, as a member of the Bombela Consortium, was awarded a contract by the Gauteng Provincial Government of South Africa to provide an 80 km rapid rail transit system to connect Johannesburg, Tshwane (Pretoria) and the OR Tambo International Airport. The complete system commenced service in June 2012.



Bombardier delivered the design and supply of the core electrical and mechanical systems for Gautrain, a prestigious project including a fleet of 96 state-of-the-art *BOMBARDIER* ELECTROSTAR** vehicles, as well as providing 15 years of maintenance services together with our local Broad Based Black Empowerment partners.

The majority of the 96 Gautrain vehicles underwent final assembly in South Africa. The *ELECTROSTAR* vehicles are designed for commuter operation and are capable of operating at speeds of up to 160 km/h.

The new intercity system features the *BOMBARDIER* CITYFLO* 250* train control technology, well proven on transportation systems in Europe. The Gautrain project created more than 8,200 local direct jobs, and an estimated 44,300 indirect jobs.



IMPLEMENTING ONE OF THE LARGEST RE-SIGNALLING PROJECTS IN SOUTH AFRICA

As leader of the consortium Bombardier Africa Alliance, Bombardier won a contract at the beginning of 2013 to implement one of the largest conventional mainline re-signalling projects in South Africa.

The consortium, which includes ERB Technologies, Basil Read, Bakara Engineering, R&H Railway Consultants, SIMS and Tractionel, is delivering the globally-proven, state-of-the-art **BOMBARDIER* INTERFLO* 200** rail control solution for the Passenger Rail Agency of South Africa (PRASA). The planned increase in trains operating on the lines is set to enhance mobility for about 700,000 passengers daily in the region.

The **INTERFLO** signalling solution, scheduled to be delivered by 2017, will enable 2.5 minute headways, eliminating bottlenecks while increasing safety and availability at 42 stations and 120 km of double-track. The upgrade also includes the latest version of the high capacity **BOMBARDIER* EBI* Lock 950** computer-based interlocking and **EBI Screen 900** central traffic control (CTC) system as well as replacement of all wayside equipment. Associated telecommunications equipment is being provided while the civil works include modifications to existing platforms, track and overhead equipment and new pedestrian bridges.

THE FIRST CHOICE FOR RELIABILITY, AVAILABILITY AND MAINTAINABILITY

Bombardier Transportation is used to the attention directed to the new trains it delivers worldwide. Yet it has an equally significant services business, dedicated to supporting customers throughout the life cycle of their rolling stock, offering services including:

- Fleet Maintenance
- Operations and Maintenance
- Vehicle Refurbishment and Modernisation
- Material Management
- Spares Supply
- Innovation and Technology

Our Services team in South Africa is setting high standards for the rail industry to follow. Not only are they involved in ongoing refurbishment programmes, like the 11E project that began in 2009 to overhaul the static inverters on the 11E coal line fleet in Richards Bay, the team are also leading in innovative maintenance systems like the new AVI System.

The Automated Vehicle Inspection (AVI) System

Bombardier's engineering teams combine the strengths of design authority expertise, information systems and

technical innovation to deliver maintenance service systems that are exclusive to Bombardier. Another world first innovative development is our Automated Vehicle Inspection System - The (AVI) System.

The AVI System combines external measurements with the train's onboard data to optimize overall maintenance. Our South African Gautrain Maintenance team is pioneering this project for Bombardier and has two sites at the Midrand Depot currently compiling the analytical information.

At the first site various measurements on wheel profile, pantograph, axles, brake pads and discs among others are collected as the train passes through. At the second site an array of strain gauges measure wheel tread damage. The *BOMBARDIER* ORBITA** software combines and analyses the data to determine what repairs and maintenance need to be carried out.

The AVI system increases reliability, improves maintenance safety and reduces overall maintenance costs.



THE EVOLUTION OF MOBILITY

LOCOMOTIVES

The *BOMBARDIER* TRAXX** locomotive family incorporates electric and diesel-electric locomotives for freight and passenger services based on the Class 185 platform concept.

It consists of the following types:

- AC Locomotives (alternating current)
- MS Locomotives (multi-system)
- DC Locomotives (direct current)
- DE Locomotives (diesel-electric)

The *TRAXX* locomotives cover all types of railway applications in Europe. They operate on all UIC standard gauge railways and in cross-border freight and passenger services. Standardization and modularization enable a high degree of system and component commonality. All *TRAXX* locomotives feature a great number of identical elements, e.g. vehicle dimensions, machine room concept, brake equipment, bogies, traction motors and drive systems, signaling and communication systems, control and diagnostic

systems, as well as driver's cab. The operators benefit from significant savings in operations and maintenance through low life-cycle costs, high operational availability and the service-friendly design of our *TRAXX* locomotives.

GPS tracking, GSM remote diagnostics and video cameras for monitoring the train in operation are key components of the communication systems. Prepared for the European Train Control System (ETCS), the *TRAXX* locomotives are ready today for the trans-European traffic needs of tomorrow.

To date, more than 1,600 *TRAXX* locomotives have been ordered, hauling freight and passenger trains on a daily basis, many of them on cross-border services.

In 2012 Bombardier presented an innovation with pure diesel operation: the *TRAXX* P160 DE Multi-Engine. Its four diesel engines provide it with performance flexibility in new dimensions. Both freight and passenger transportation operators profit from this.







OPTIMISING THE MOVEMENT OF ORE AND FREIGHT

The efficient movement of freight 24 hours a day, 365 days a year, is essential to a modern and productive resource industry, vital to support growth, skilled jobs and industrialisation. Specifically designed for industrial and mining applications, *BOMBARDIER* INTERFLO*150* optimises and maximises the rapid transport of raw materials to enable fully automated continuous, efficient and streamlined productivity.

As a proven hi-tech signalling solution, *INTERFLO 150* successfully combines industrial logistics and automation to significantly increase efficiency, capacity and safety in the most innovative and cost effective way. This is achieved by introducing a communication-

based train control (CBTC) system with moving block technology which is fully automated, driverless, integrated with a mine's loading and unloading systems and scalable to the customer's requirements.

Bombardier is a leading provider of rail control solutions and turnkey projects which have been supplied to the mining industry worldwide. Our systems have been installed in wide-spread remote locations ranging from the world's largest copper reserves within Codelco in the Chilean Andes, to more recent installations in one of the world's most automated underground mines, LKAB in northern Sweden.

MAKING LEVEL CROSSINGS SAFER

In many countries across the world, serious or even fatal accidents continue to occur on level crossings despite numerous public safety campaigns warning of the danger of level crossings. There are currently over 7,500 level crossings in South Africa.

Bombardier's *EBI* Gate level crossings are suitable for both road and pedestrian use in an urban environment as well as being designed for railway lines which are currently "open" or "uncontrolled". They can be operated automatically or manually by the crossing keeper, train dispatcher or in rural locations by a member of the general public.

Products include:

- ***EBI* Gate 2000** - An automatic level crossing system which can be installed on a single or multiple track line, electrified or non-electrified.
- ***EBI* Gate 200** - The first crossing of its kind designed to harness renewable energy through wind and solar power, the system can be easily installed as an overlay system independent from any existing railway infrastructure. It is ideal for rural locations and is easy to operate.
- ***EBI* Gate 100** - A pedestrian platform crossing which can be used with an interlocking or as a stand-alone system.





A NEW SENSE OF SPEED

Bombardier's response to today's challenges has been to introduce a radically new and comprehensive definition of very high speed (VHS). All the expertise and experience gained from building more than 850 high and VHS trains in the past two decades has been invested in the development of a new very high speed train: the *BOMBARDIER* ZEFIRO**. The outcome is a new sense of speed in VHS rail travel. A top operating speed of 380 km/h and a VHS sleeper version that flies through the night at 250 km/h are evidence enough.

The *ZEFIRO* comprehensively redefines VHS rail travel by adding the dimensions of very high efficiency and very high dedication to that of very

high performance. The *ZEFIRO* is one of the world's most economical and eco-friendly VHS trains.

The open tube layout in the *ZEFIRO*'s non-articulated train concept enables capacities to be adjusted to accommodate between 450 and 1,300 seats. If the maximum seating arrangement is chosen, the *ZEFIRO* has the highest capacity of any VHS train.

It combines the highest capacity in the market with pioneering levels of passenger comfort and employs leading-edge technologies and advanced aerodynamics to reduce energy consumption. Just the standard-setting VHS train you would expect from a global leader in rail technology.



INTRODUCING TRUE ELECTRIC MOBILITY

With the *BOMBARDIER* PRIMOVE** e-mobility portfolio, we are introducing a complete package that allows cities and the transportation industry to easily incorporate electric mobility for improved economics and quality of life.

PRIMOVE reduces local CO₂ emissions to zero, enabling true emission-free mobility. It eliminates noise pollution for both a quieter ride and living alongside bus and tram lines. And it integrates seamlessly into the environment an invisible system that needs no cables, wires or plugs.

Designed for all types of electric vehicles

When it comes to trams, catenary power systems are complex to install, demanding to maintain and clutter urban areas with unattractive infrastructure. *PRIMOVE* solutions equip light rail vehicles to run without any unsightly poles or overhead cables in any climate or weather.

For electric buses, the *PRIMOVE* package represents a major leap forward by creating a competitive alternative to diesel and hybrid systems. It offers a wireless charging system that is fast, easy to integrate and convenient to use. Together with the *PRIMOVE* high power battery, it turns planned stops into charging opportunities without requiring additional vehicles, interrupting service or affecting dwell times.

Adding the reliable and high performance *PRIMOVE* propulsion and controls solution ensures a 100% smooth and quiet ride for passengers. For private cars and commercial fleets, the *PRIMOVE* system overcomes charging constraints, freeing electric automobiles from range limitations with a fast, safe and automatic charging process. The compact system fits into the underside of any car and requires no plugging, making e-mobility more convenient than ever before.

Why Choose *PRIMOVE* e-Mobility

- **Clean** – No emissions, carbon or noxious gases for a healthier environment
- **Quiet** – No noise or vibrations for greater passenger comfort
- **Invisible** – No cables, wires or plugs for more attractive cities
- **Energy Efficient** – Fast charging and minimized energy loss for reduced operating costs
- **Practical** – Small and compact products for easy maintenance and higher passenger capacity
- **Complete** – A one-stop-shop that delivers a turnkey system solution for true e-mobility



FLAGSHIP PERFORMANCE IN DRIVERLESS SYSTEMS

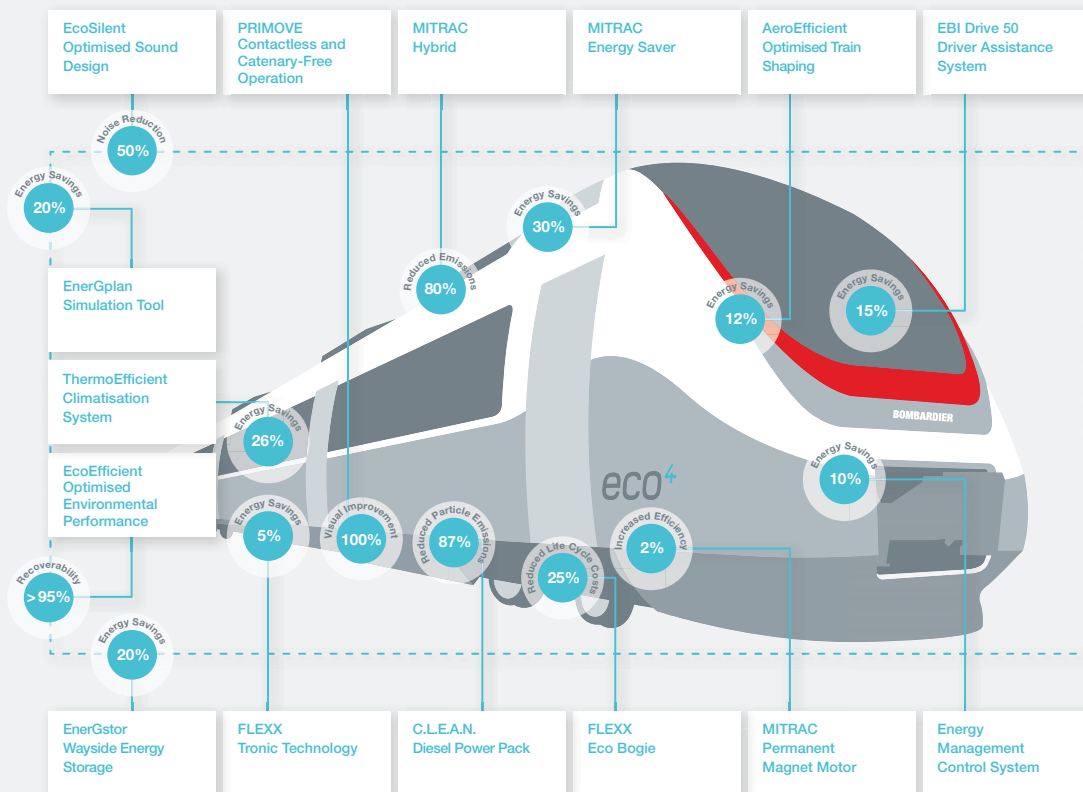
From airport links to principal mass transit arteries, *BOMBARDIER* INNOVIA** Monorail systems have been moving passengers safely, efficiently, comfortably and reliably to their destinations day after day since 1991.

Over the last two decades, *INNOVIA* Monorail technology has continued to evolve in order to meet new challenges and demands facing transit and

planning authorities. *INNOVIA* Monorail systems lead the industry with their sleek and modern appearance as well as low maintenance and life cycle costs.

Our *INNOVIA* Monorail systems have been developed to minimise the costs and disruption of civil construction. The pre-cast, post-tensioned elevated guideway structure is constructed off-site to permit exceptionally rapid assembly on location.





ROADMAP FOR SUSTAINABLE MOBILITY

BOMBARDIER* ECO4* is both a product portfolio and a roadmap for sustainable transport solutions. These fully operational technologies represent a game-changing approach to rail technology that's both performance based and environmentally driven.

Aligned with operator requirements and easily customized to any fleet, our innovative **ECO4** solutions advance sustainable mobility by:

- Optimizing energy use
- Decreasing energy waste
- Minimizing CO₂ emissions
- Increasing economic value
- Improving overall efficiency and total train performance

Sustainability is the key issue when it comes to energy use for both the transportation industry and our planet. Leading the way in modern mobility, we introduced our first cutting-edge **ECO4** technologies in 2008.

Today our **ECO4** portfolio includes 15 energy-saving solutions that serve as the backbone of modern fleet management and rail technology.

Bombardier Transportation has an active set of environmental print guidelines, for further details visit: www.transportation.bombardier.com
Learn more about our commitment to sustainable mobility at:
theclimateisrightfortrains.com

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