



Desiro City

Evolution in motion

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SIEMENS



The world is changing.

Each market has its own special requirements. In the UK train operators and commuters face a multitude of challenges: Commuter trains have to network suburbs and interurban regions conveniently as well as deliver fast, punctual and efficient

inner-city services. Passenger volumes continue to increase while at the same time the impact on both the infrastructure and the environment needs to be reduced. This calls for flexible, innovative systems that enable improved utilisation



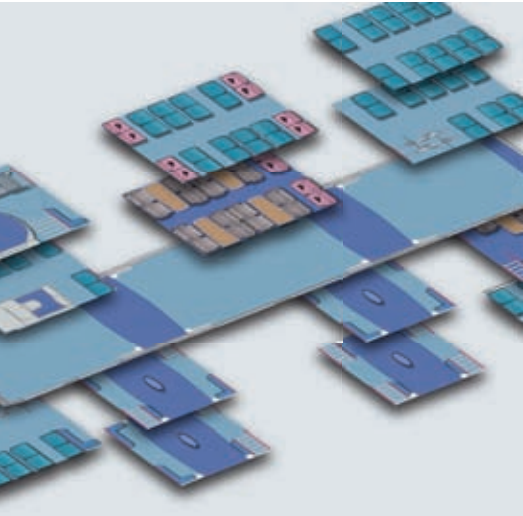
of existing resources. Proven systems with high availability and reliability, which ensure profitable and cost-effective operations. Systems that offer increased cost effectiveness for operators. Systems that are specifically developed for the UK commuter market. Systems that are incorporated in the new Desiro City. Since early 2007, Siemens has invested significant research and development to ensure that the new Desiro City platform meets the

demands of the UK market. The Desiro City is based on tried and tested proven technology from the existing Desiro platform family, incorporating the latest innovative features that will set a benchmark for commuter rail services in the United Kingdom.

So is an excellent train.

The evolution of commuting

The movement of high volumes of passengers with frequent, irregular stops on diverse routes calls for a train that combines service-proven technology with ultramodern equipment. Meet a proven platform concept that features innovations of the next generation: Meet the Desiro City.



Flexibility and Comfort

Flexibility is crucial when it comes to future train formation changes, redeployment, or route upgrades, as well as operational adjustments to actual passenger volumes. The Desiro City caters for both: It provides a high level of flexibility regarding train configuration, and interior layout. This is achieved by a Single Car Concept with each motor car being equipped with all necessary traction components. The result: Any train configuration and passenger capacity can be accurately dimensioned without jeopardising dwell times. Wish to increase the number of seats or provide more bicycle stowage space? No problem, the entire interior design is modular and provides maximum flexibility regarding the saloon layout. For example, the floor areas are kept clear of under seat equipment, no electrical cabinets are located in passenger areas, and the number of interfaces between the interior components has been minimised. As a result, the entire interior layout can be tailored to your specific needs without long workshop hours – allowing adjustments even at short notice. At the same time the ultra-modern interior design offers extraordinary comfort for the passengers.



Energy efficiency

The Desiro City has been designed with energy efficiency in mind, delivering drastically reduced energy consumption. Therefore, we have undertaken meticulous analysis and design iterations in order to significantly reduce train weight. Bogies, car bodies, interiors and the electrical equipment including the cabling, as an example, are weight optimised – resulting in up to 25% weight reduction compared to the existing UK fleets. For example, the traction and auxiliary converters are designed using the latest IGBT-technology in order to minimise the use of heavy magnetic components, and more important, reduce switching losses. In addition, we have integrated an innovative DAS – Driver Advisory System, developed a new cab shape with improved aerodynamics, and implemented energy-efficient LED-lighting as well as an intelligent air conditioning system with CO₂ sensors which control the flow of the fresh air according to the number of passengers. Furthermore, an optional innovative onboard energy storage system allows for the use of braking energy for reacceleration. As a result, the vehicle is able to reduce its primary energy consumption by as much as up to 50%. The Desiro City – a modern, lightweight, efficient and environmentally friendly train.

- Innovative Single Car Concept
- Modular interior design
- Lightweight train and bogie
- Air conditioning with CO₂ sensors
- Optimised maintenance friendliness
- Unique test track in Wegberg-Wildenrath
- Proven UK expertise

Reliability and Availability

With 1,500 rail vehicles already running or on order, the Desiro platform has a proven track record in the UK. As a next generation solution, the Desiro City is based on highly reliable technology and incorporates experience gained over many years. It is designed for high capacities with frequent, irregular stops on diverse routes with the objective of achieving best-in-class service performance, low levels of failure, and intelligent equipment redundancy to allow maximum availability. In order to deliver trains that work 'straight out of the box', each train is fully tested to UK standards on Siemens' unique test track in Wegberg-Wildenrath. In addition, intelligent use of onboard train management and monitoring systems permit optimised maintenance exam periods and overhaul intervals. For example, by using operational data with a robust optimisation program maintenance control centres can operate balanced maintenance regimes alleviating the need to stop units for long time periods. This maximises continued availability and operational revenue over the entire life of the train.



Whole Life-Cycle Costs

Weight reduction, track-friendliness and a broad drive to improve energy-efficiency and maximise reliability provide leading optimised Whole Life-Cycle Costs. In addition, a major element of the rigorous design process was focused on reducing maintenance and cleaning costs. The implementation of comprehensive, optimised diagnostics and condition monitoring for the traction, brake and pneumatic systems, external doors and train management system ensures the ability to achieve highest levels of performance and service reliability. In combination with the introduction of predictive maintenance methodologies and improved repair accessibility maintenance costs are minimised. The same applies to cleaning accessibility. Thanks to the use of cantilever seat fixings, the floor is unobstructed to facilitate easy, fast and efficient cleaning. In addition, careful and consistent selection of vandalism resistant materials for interior and toilets significantly reduce costs.



**Environmental friendliness and
low operational costs go hand in hand**

The technology of the fittest

Are you ready to go for a ride on a train which adjusts to passenger volume changes quickly and economically? You are welcome on board the Desiro City. Feel free to explore a platform concept that uses resources effectively and never consumes more energy than really needed.



- **Easy adaption to actual passenger capacity**
thanks to Single Car Concept
- **Improved energy efficiency**
thanks to lightweight construction and intelligent systems
- **Safe operation**
thanks to meeting the very latest standards

Configuring the future

The traction concept of the Desiro City is based on an electrical multiple unit with distributed traction equipment. To achieve maximum flexibility and modularity all necessary traction components are integrated in one single motor car. This means, all motor cars are identical and consist of a traction container with an integrated auxiliary converter, drive unit, line filter and braking resistor. In addition, the motor cars are designed as end and intermediate cars, even motor cars with reduced traction are available. Therefore it is possible to achieve any passenger capacity, length

and configuration you like – including a tailored performance. For efficient customer configurations to suit your operation, just combine the desired amount of trailer cars with the appropriate number of motor cars. The trains can be reduced or enlarged in length to build units of up to 240 m in length without fearing that the performance is over- or undersized. Compared to conventional motor cars their performance is highly improved thus allowing ideal performance levels required for short dwell times in inner-city and suburban services. The result is a train that you can tailor precisely to your specific needs.

Running on every track

AC 25 kV/50 Hz (60 Hz)
via pantograph

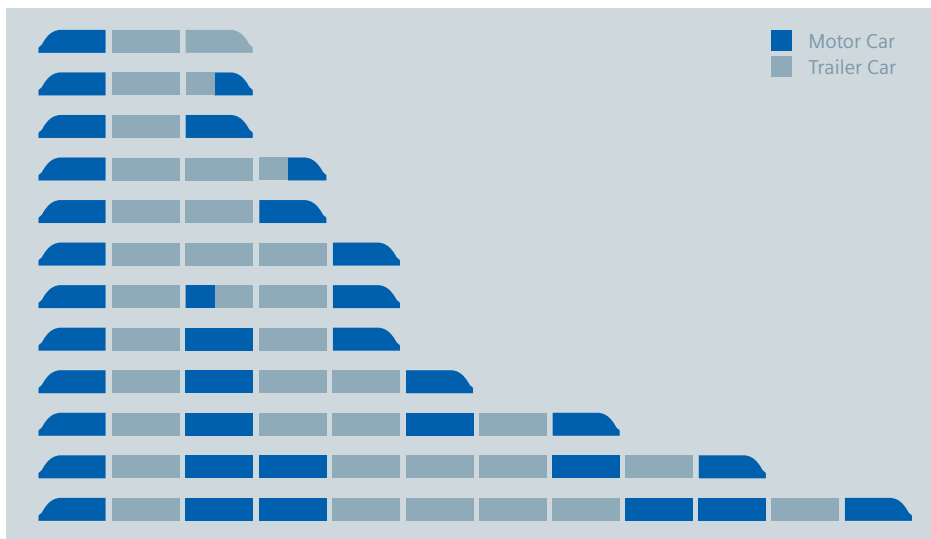
DC 750 V
third-rail

AC/DC
dual-mode

Simple, automatic switch
between AC and DC

The Desiro City platform is a highly flexible concept, capable of running as an overhead electric or 750-V-third-rail or dual-mode train.

Some examples of possible train configurations



Thanks to the Single Car Concept, performance and capacity can be scaled accurately.

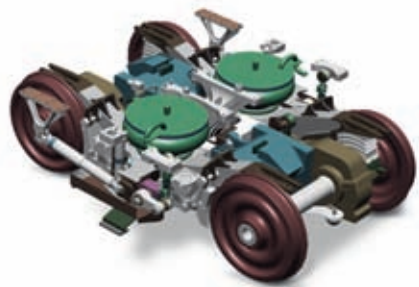
Tailored for reliability,
high capacity and short dwell times

Reducing maintenance efforts

The Desiro City bogies are two-axle air-sprung bogies with two-level suspension. They complement the successful SF 5000 UK bogie which is the standard bogie fitted to the Siemens Desiro fleet with approx. 3,000 bogies in operational service. The improved bogie uses inboard-bearings and is very compact which makes it much lighter than an outboard-bearing bogie type. All measures result in a reduction of approximately one third of the weight compared to a conventional bogie. The mass reduction not only contributes to lower energy consumption: The minimised unsprung mass together with a reduction in axle distance (compared to a standard bogie) significantly decreases the wheel and track wear damage. This minimises the wheel maintenance costs and variable track charges. Another key feature is its ability to cope with much higher vehicle payloads while keeping the same level of safety against derailment.

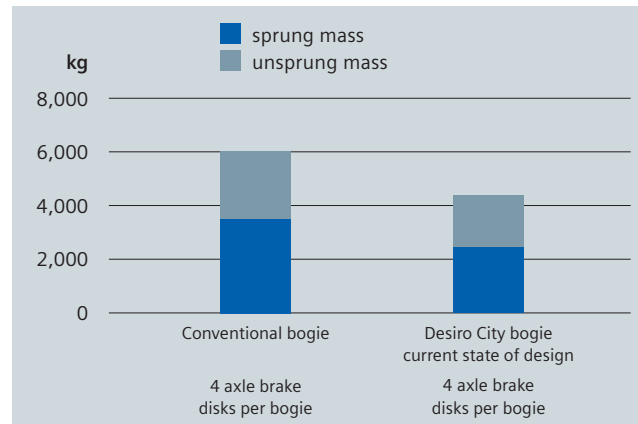


Trailer bogie: Only 2,100mm wheelbase and the very low weight of the new bogie design lead to significant improvements in energy consumption, track-friendliness and wheel wear.



Motor bogie: Due to the inboard bearing concept, the bogie is very compact. The traction motors are integrated in the bogie.

Trailer bogie



The complete redesign of the bogie allows for a reduction of unsprung mass due to smaller wheel diameter, axle length, axle bore-hole and braking equipment which results in reduced variable track charges and extended maintenance intervals.



Saving energy and sustaining the environment

- Significantly reduced train weight
- Improved aerodynamics
- Redesigned traction and auxiliary supply systems
- Energy-efficient driving thanks to Driver Advisory System
- Intelligent heat, ventilation and air condition system
- Reporting tool for measuring the traction's energy consumption
- Utility of braking energy thanks to energy storage system

Enabling a safe and clean environment

With its clear internal layout, wide aisles and good visibility throughout, a ride in the Desiro City is accompanied by a reassuring air of safety – for both passengers and driver. And that is entirely justified, because the Desiro City has been designed to meet the very latest safety standards. In ensuring optimal crashworthiness, all the crash scenarios defined by EN 15227:2008 and TSI Crash, scenarios I to IV, were taken into consideration as well as TSI fire protection vehicle category A with materials according to BS 6853 category 1b. The

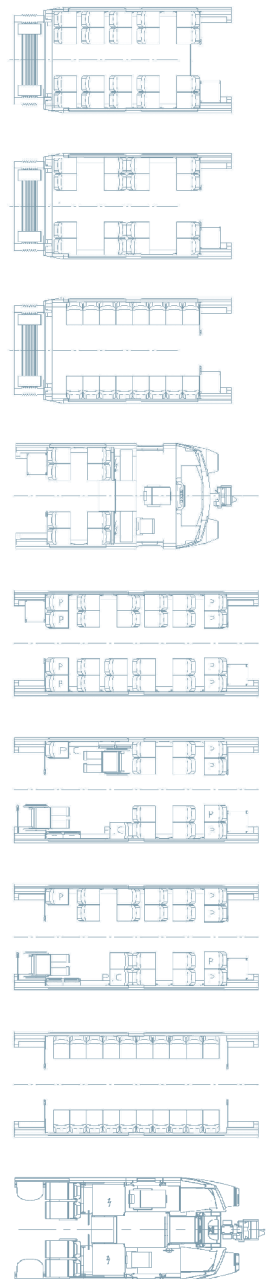
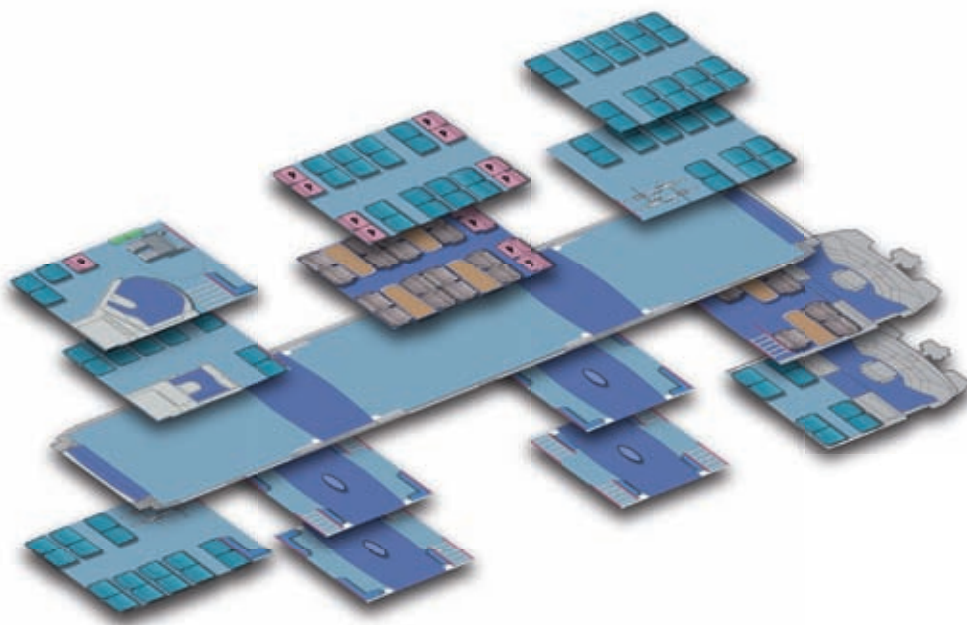
high level of safety is ensured by early fire detection in combination with an intelligent ventilation system which is used actively in case of a fire to lead the smoke outside the train and to ensure a place of relative safety inside the train. The Desiro City is also fitted with a video surveillance system for extra security. In addition, we always consider potential consequences for our environment. It is our aim – also in excess of applicable regulations – to avoid ecological damage or reduce it to a minimum. Therefore, we ensure a recycling quota of 95%.

Preserving a good climate

Environmentally friendly, quieter, comfortable, and state-of-the-art: The heating, ventilation and air condition system is equipped with CO₂ sensors that control the flow of fresh air according to the number of passengers in each car. The system is designed according to EN 14750 regarding saloon and EN 14813 regarding driver's cab HVAC systems, and incorporates special features. The operational mode 'Free-Cooling' is a transition between heating and cooling mode in which the saloon is ventilated with an increased amount of fresh air without active use of the refrigerant cooling system in order to keep internal temperature comfort levels. For unoccupied areas or low occupancy, an intelligent shutting down management is provided. All these measures help reduce the total energy consumption while at the same time meet your passengers' satisfaction. All this, whilst reducing noise levels in the passenger area.



- Meeting future requirements thanks to a vast variety of layout options
- Ensuring reduced redeployment costs thanks to maximum modularity
- Optimising passenger flow thanks to spacious vestibules
- Allowing high capacity loadings by additional standing space
- Additional standing area thanks to wide and safe gangways

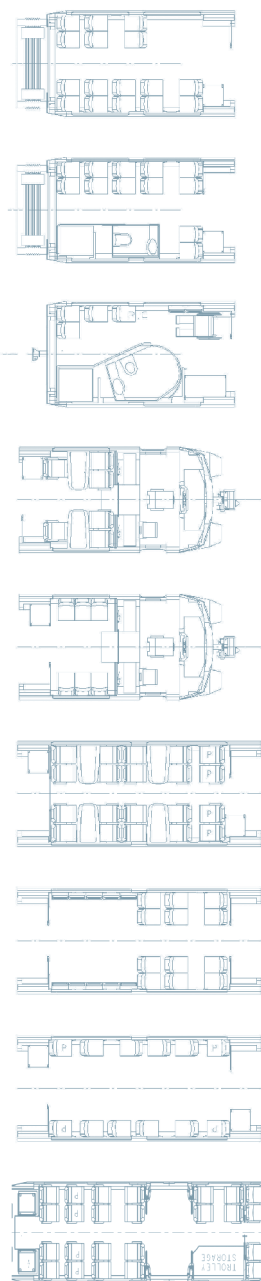


Continuous body-side mounted tracking systems and the elimination of any floor fixings ensure complete freedom, e.g. the seats can be repositioned in order to provide bay- instead of airline-seating, to form First Class instead of Standard Class areas, to install bicycle modules instead of seats.



The freedom of space

The vacation season is here – and with it lots of luggage. But where is it all going to be stowed? The answer is to adapt to seasonal changes and demand flexibly. The Desiro City saloon layouts can be tailored to any seasonal, capacity, and route upgrade requirements.



Considering tomorrow's needs

The Desiro City's saloon is developed for maximum interior flexibility. This was achieved by minimising the number of interfaces between interior components. Structural changes after assembly or disassembly of components are not necessary. As a result, it is possible to dismantle the entire seating. Furthermore, refurbishment times and costs of individual panelling components have been reduced to a minimum. Consequently, you can realise almost any saloon layout you like. Feel free to tailor First and Standard Class precisely to your needs.

Adjusting to capacity changes

The completely flexible layout concept allows reconfiguring the saloon areas to suit any capacity changes – even on very short notice. Thanks to extruded aluminium C-rails, interior trim modules can be bolted in. In combination with a standard window pitch for all cars, this ensures that the interior can be adjusted easily. Seats, tables, grab poles, draught screens, luggage modules and racks as well as the toilets can be changed in an operational depot.



The 'empty car body' concept allows for flexible and modular saloon layouts

The entire layout is fully flexible to allow reconfiguration to suit changing operational requirements. All seats and tables are cantilevered from the body side to allow a completely unobstructed floor space.



Shortening dwell times

Inviting pocket sliding doors, spacious passenger entrance areas and generously shaped vestibules allow a rapid passenger flow into and out of the car without restriction. But that's not all: The inter-vehicle connections are completely open, wide (up to 1,800 mm) and unobstructed to allow rapid passenger transit between vehicles. At times of very high passenger loadings, the areas can function as a vestibule by providing additional standing space in a clean and comfortable environment for passengers.

Informing the passengers

Informing passengers means optimising passenger flow and satisfaction – especially with a passenger information system of the next generation. It provides comprehensive information regarding seating and standing capacities, delays and interchange connections, entertainment and advertising – visually and audibly. The information data is fed in wirelessly using the Siemens own Remote Data Access System. Large conveniently located TFT displays ensure all over visibility and can be viewed from both sides of the passenger saloon.



The passenger doors are spacious pocket sliding doors with a throughway of approx. 1,500 mm and a clear height of minimum 1,900 mm. The Desiro City also supports various door widths and types including plug sliding doors. In addition, two dispatch modes are available: rapid metro mode and standard mode.



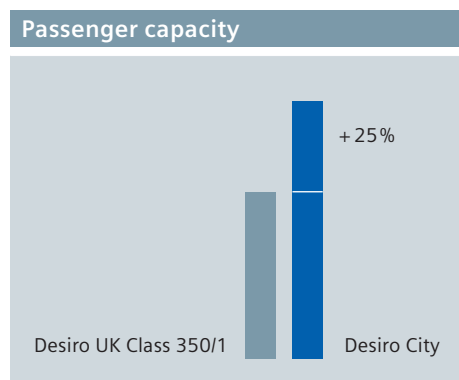
The on-board PIS system provides general information, guidance and warnings to passengers. It is given on display screens situated transversely at each vestibule. The screens can be mounted at the top of the vestibule totem or at the ceiling where no totems are installed.



Combining high-volume and comfort

Well designed interior panelling and modern lighting create a pleasant travelling atmosphere. Large windows at a height suitable for both sitting and standing passengers enable a good view during the journey and generate the impression of a spacious interior. Nevertheless the entire saloon concept is focussed on exploiting the available space. Electric cabinets are no longer located in the passenger saloon. They are now mounted in panels between interior ceiling and car body roof. This allows for wide, spacious vestibules provid-

ing additional standing space. The safety of people standing is ensured by a well thought-through crash-concept. It takes into account absorption of collision energy in a controlled manner thanks to intermediate couplers. In addition, grab handles are provided at each aisle-side seat back. Together with numerous vertical poles and totems, including safety glass windows, they make the travelling experience more comfortable and safe during periods of high-volume passenger loads.



The Desiro City utilises the maximum furnishable space within each vehicle and is designed for maximum payloads thus resulting in up to 25% increased passenger capacity compared to the present rolling stock.



Multi-purpose areas are designed to comply fully with the requirements of PRM TSI and vehicle accessibility legislation. Up to three wheelchair /bicycle positions are provided in Standard Class.

The convenience of practicality

Whether you are taking people from one station to the next, out into the country, to and from work, on their own, in pairs or with their families: Today's UK inner-city and regional rail services have to meet the most diverse demands. This calls for an interior design that satisfies all passengers as well as operators and train owners.



- **Exceeding passenger expectation**
by raised comfort levels
- **Ensuring durability in an environment of very high usage**
by appropriate forms and materials
- **Reducing costs for cleaning and maintenance**
by an open and unobstructed design
- **Standing out from the crowd**
with distinctive and contemporary design aesthetics

Relaxing on a pleasant journey

The Desiro City has been designed to create a most pleasant and appealing travelling experience for all sorts of passengers – and comfort and capacity are not compromised. One good example: the seats. Thanks to their slim and cantilevered design, the seats allow fully open floor space. Consequently not only the passenger foot space is optimised but also the cleaning efforts can be reduced. At the same time, the seat design meets all current ergonomic requirements, thus achieving a high standard of comfort for passengers. Its contemporary and non-obtrusive design aesthetics caters for longevity.

Allowing smooth boarding

A central feature of each vestibule is the 'totem'. It provides additional hand-holds for standing passengers, can be equipped with a litter bin and a fire extinguisher. It also has the useful function of directing passenger flow at times of high-loading, thus optimising boarding and alighting. Furthermore, this totem can be used for advertising purposes. The vestibules can also be arranged without a totem whilst still providing a safe environment for standing passenger via grab rails.

An interior design that is comfortable, modern and easy to maintain



Priority seats and First Class seats will have a seat width of 450 mm excluding armrests. First Class seats are equipped with 240 V power points for laptop and mobile phone use. A laptop-size fold down table is also integrated.



The central totem with optional integrated waste bin separates the passenger flow, leading it into the adjacent passenger compartments. It is equipped with two handrails for passengers standing in the vestibule.



The standard seats have a slim visual aesthetic which gives a contemporary design appearance to the Standard Class saloon and creates a feeling of spaciousness in the vehicle. The seat width is 440 mm.



First and Standard Class seating has been designed with the latest knowledge of ergonomics as well as considering additional space and passenger comfort.

Creating room for luggage

Luggage racks are fitted in all seated areas except for sections with a low ceiling. In addition a variety of luggage stack modules are available. They can be implemented close to the entrance areas or at the end of the saloon in the multipurpose areas. Therefore, the shelf can be raised to allow the safe carriage of bicycles, while the luggage rack extends over the top of the stack to allow the stowage of additional luggage items. Tip-up seats for this area are also provided for use at times of very high passenger demand.

Raising standards for hygiene

The toilets offer a high level of functionality and hygiene to the passenger as well as simplicity of maintenance for the operator. While fully meeting high standards for maintenance and the ease of cleaning, the choice of materials, colours and fittings seeks to exceed the passenger expectation and raises the standard for on-train toilets. The very robust design of toilet fixtures, such as the hand dryer and paper holder, is an effective measure against vandalism. The toilet reliability, which is a key driver in passenger satisfaction, is also ensured. Its vacuum system is based on proven equipment that has demonstrated much higher levels of availability compared to systems currently in use. In addition, the improved door mechanism allows better door drive accessibility for easy maintenance.



The combination of luggage stack and draught screen saves space and allows maximum flexibility. The fixing at the body-side caters for an unobstructed floor which is a significant feature of the entire vehicle design.



The toilets are of light-weight, modular construction. The universal toilet is fully compliant with the requirements of PRM TSI and offers disabled passengers a safe and comfortable environment.



Illuminating with efficiency

A variety of lighting options are provided, all of which utilise the latest LED lighting technology. This achieves very desirable weight and energy savings, and more significantly, delivers major cost savings in maintenance and cleaning. The units are fully sealed, have a very long service life which far exceeds comparable fluorescent light sources and require no routine maintenance. The units can be arranged either transversely or longitudinally. Light levels can be varied. Feature lighting is achieved by utilising the flexibility of the LED panels.



The use of the latest LED technology increases lighting reliability, durability and efficiency. In addition, the units are completely sealed against dust and dirt which means reduced cleaning efforts.

The tradition of reliability

Over 160 years presence in the UK, 1,500 rail vehicles already on track or on order, owner of 84% of all recently established depot facilities in the UK – Siemens has a proven track record of UK experience.

Innovating technology

For over 160 years, Siemens has been a global powerhouse, standing for technical achievement, quality and reliability. In 1850, we recognised the importance of the UK market and opened our first office in London. Today, with over 18,000 employees we are one of the UK's leading technology companies. With over 1,500 rail vehicles already in use or on order, Siemens trains are a familiar sight and well established on the UK rail network. Desiro trains run from Glasgow in Scotland to Weymouth in the South of England – providing an enhanced travel experience for passengers and cost-effective solutions for owners and operators based on the latest safety standards.

Assuring responsibility

Siemens offers comprehensive support to ensure that our products meet our customers' requirements: from technical support and finance packages through to long-term maintenance and repair services. Our track record of 'delivering our promise' is renowned and demonstrated by our reputation that we do what we say. Built over many years, our excellent credit rating gives proof of Siemens' credibility and assurance of long-term stability and strong financial standing. Besides our dedication to on-time, on-budget delivery, Siemens is also committed to the UK market with over 5,000 manufacturing jobs and even more manpower in the supporting supply chain.



Krefeld-Uerdingen is one of the world's leading rolling stock manufacturing plants. Onsite the body shells are manufactured, the cars are assembled and the commissioning service is carried out.



Vienna bases its production on the latest manufacturing technology with high-performance robotic welding. An assembly area of almost 14,000 m² allows for production of up to four cars at a time.

2002



Class 360 ONE



Class 444 SWT



Class 450 SWT



Class 360/2 HAL



Class 185 TPE

2005



Rolling stock, maintenance services and financing package from one single source

Manufacturing high-quality trains

Siemens has a high proportion of in-house manufacturing expertise which ensures that all components are delivered on time to the highest quality standards. This includes: body shells, final assembly, bogies, TMS, traction, transformers, electric on-board equipment, cable looms, drivers desks and safety systems. Our production site in Krefeld-Uerdingen is renowned for its comprehensive package of manufacturing excellence and contingency support and is backed up by our plant in Vienna.

Providing services nationwide

We consider ourselves as a full-service provider for railway solutions. Therefore, we have been extending our depot facilities constantly. In the last 12 years we have established five new 'state of the art' train care depots and are involved in the sixth depot project. More precisely: 84% of all new depot facilities in the UK have been carried out directly by Siemens or its subcontractors. In addition, our outstations and 'mobile technicians' network provides cost-effective solutions for delivering maximum availability and reliability.

Ensuring smooth operation

The company's purpose-built test and validation centre in Wegberg-Wildenrath has been reconstructed to replicate UK network conditions following a multi-million Euro investment. The test tracks ensure that all trains are fully tested in a Network Rail approved environment – prior to their entry to the UK. This allows fault free mileage accumulation for each vehicle and avoids disruptions on the busy UK rail networks. In addition, Wegberg-Wildenrath offers on the job training for drivers and maintenance as well as operational personnel.



With 28 km of track and special testing equipment, the Wegberg-Wildenrath Test- and Validationcenter has no difficulty in simulating train operations under any real-life conditions.

2007



Class 350 WCML



City Line/Express



Class 350/2 WMF



Class 380 FG

2010



Desiro City

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The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.

