



ALL IMAGES: SIEMENS MOBILITY

Welcome

What a difference a year makes! If anyone had asked me last year what my priorities might be in my first year as CEO of Siemens Mobility Limited, I'm not sure that my answers would have been wholly accurate!

Without a doubt, the COVID-19 pandemic has been the number one topic on my mind. Brexit has all but been forgotten by most people as a result. COVID-19 has changed what we do and how we do it and, for our industry in particular, the impact has been pretty phenomenal. Instead of capacity constraints we've been talking traveller (and staff) confidence. Instead of face-to-face meetings we've become experts on video conferencing and collaboration platforms.

I'll be the first to admit it has altered my views on productivity and effectiveness. More generally, it has triggered the reassessment of future working patterns and places. For Siemens this has been a very clear message – even post-COVID-19 our working model will mean people working from home or other remote locations for two/three days per week. As a result we will very much focus on outcomes, rather than time spent at the office. Of course, we've adopted flexible working policies for many years now, but this takes things a step further. We'll help our people choose where they are most productive and what works best for them. It's a win-win scenario.

I mentioned traveller confidence at the start of my introduction. As an industry it is clear we have a significant part to play in this. We need to help people feel safe to travel. Whether that's two days a week in the future or whether that's the pre-COVID-19 five-day commute. There are a lot of people who've been very nervous about passenger number reductions. I'm pretty clear about this. Our railways were at bursting point,



WILLIAM WILSON
SIEMENS MOBILITY CEO UKI

our roads congested. We now have an opportunity to reassess and do this right. And that means bringing about the best economic benefit for the UK. My colleagues and I have spent many hours and days looking at what we can do. In the following pages you'll be able to read about real-life examples of what we've been doing. It may involve using 'blue sky thinking' to come up with new solutions, or considering what already exists that could be used in different ways. I'm proud that Siemens Mobility can be so innovative and entrepreneurial.

One by-product of the global pandemic has, of course, been the reduction in CO2 emissions. As fewer people have travelled, so pollution has decreased. That's brought into sharp focus the topic of decarbonisation. It's not that people weren't aware of this before, it's more that they've had the time to consider it more and see the positive environmental impact. The UK has some

tough challenges to meet. Net Zero by 2050 will be no walk in the park, and UK. As a result, the Department for Transport is in the middle of consulting on its decarbonisation plan. Eliminating diesel trains from the network and looking again at electrifying large parts of our railway is just one part of the solution. Investment in infrastructure and clever thinking is needed. Luckily I'm surrounded by very clever people!

I hope that when we look back, a year from now, we'll see some very positive developments for our rail industry and our country. Part of our job is to guide and advise on reaching productive solutions for us all. After all, we employ many thousands of people here and have been present in the UK since Victorian times, so we have a vested interest in helping the UK economy get back on track. To coin a phrase... build back better, build back greener, build back faster. ■

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MOBILISING THE ECONOMY

The far-reaching effects of the coronavirus pandemic have been keenly felt in all areas of society, but perhaps nowhere more visibly than on public transport.

Owing to a national lockdown of everyone except key workers from late March, combined with the continued need for social distancing, passenger numbers remain far below what they were just six months ago.

Travel restrictions have now largely been lifted as we adjust to the 'new normal' of living with the threat of the disease while mitigating the risk of transmission.

Demand for public transport is once more on the rise, although it is accepted that fully restoring passenger confidence will take much longer to achieve.

Indeed, research conducted by Siemens Mobility in the UK indicates that some 86% of the public associate rail travel with a heightened risk of exposure to coronavirus.

This rises to 95% of those who exclusively use the railway to commute in normal times, despite separate research conducted by RSSB pointing to the risk of infection being broadly the same for rail as travelling by car.

This lack of confidence among passengers has led to a difficult financial climate for operators and also governments, with increased public spending often required to keep transport networks fully functioning.

This is compounded by uncertainty over what permanent changes to travel patterns will now follow owing to the recent and well-embraced rise in home working.

But there is no doubt that the UK's wider economic recovery from the current recession will depend on the increased mobility of people and goods.

Connecting people to jobs, social networks,

Siemens Mobility is poised to turn adversity into opportunity as the rail industry squares up to the challenges of coronavirus and the lockdown

education and leisure activities, public transport is also vital to ensuring that the recovery is environmentally sustainable and that congestion and pollution arising from private car use is minimised.

Siemens Mobility recognises that people need to feel safe to travel by public transport again and have approached the challenge both from the point of view of the operator and of the passenger.

It has subsequently developed a suite of bespoke tools, products and options that will not only help to restore confidence but also increase the resilience of public transport to COVID-19.

Alex Stewart, general manager Inter Modal Solutions at Siemens Mobility Limited explains: "When the first cases of coronavirus were confirmed in the UK in January, I don't think that many people realised what it would mean for the country. But after most of us were told to stay at home from March 23 we were pretty quick to look at how we could make a difference.

"We saw very rapidly that at some point we would need to get people back onto public transport and in early April published our 'four Cs' concept of cleanliness, confidence, crowding and choice. We knew that it would be important for public transport to be clean, that people had the opportunity to see how busy services would be and that they had a choice of different modes of transport, so that they could

feel more confident."

The solutions that have subsequently been developed include a variety of journey planning and contactless ticketing HAFAS web apps from HaCon, a Siemens company, that help travellers to make safe decisions about their end-to-end journeys and to be better informed.

The apps allow users to keep away from congested areas by predicting occupancy levels for lines, stations and services more than seven days in advance.

In and around London these capabilities have been enhanced by the availability of passenger loading detection and location technology installed on Siemens Class 700s operated by Govia Thameslink Railway.

The real-time data that the '700s' provide is designed to give operators a more detailed view of the utilisation of their rolling stock assets, but can also be incorporated by passenger facing apps like the HAFAS multi-modal tool.

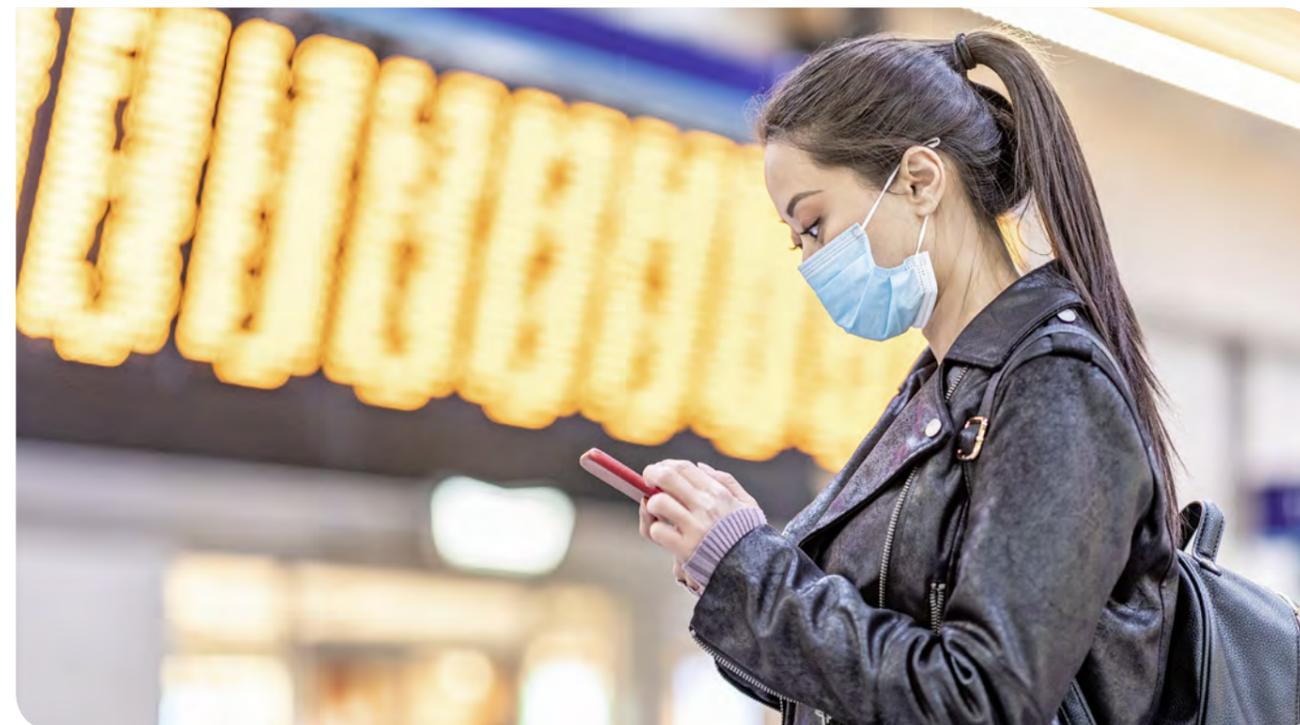
Simon Rennie, head of digital for Siemens Mobility says: "Our on-board technology offers the operator detailed insight into usage. Passengers want to be confident that social distancing can be maintained, and we knew that a combination of weight and location data could create quite sophisticated views of individual services, stations and routes.

"That gives operators the power to answer any questions and to have a good grip on planning additional capacity and more services as passenger volumes increase. The technology we use to capture data could also become an industry-wide solution and potentially be deployed on any other rail vehicle."

To help plan a route and to avoid longer transfer times than necessary, the Mobility Marketplace MaaS solution from Siemens Mobility is also particularly helpful to passengers planning door-to-door journeys.

By allowing operators to offer flexible mobility options, a wide variety of data and interfaces have been integrated into one comprehensive trip planner – from public transport to road and traffic information, car and bike-sharing providers, carpooling services, taxis and domestic flights.

Another product that Siemens Mobility is able to provide to operators to help them



comply with social distancing is its Digital Station Capacity Solutions software.

By gathering data from 3D sensors, wifi access points and more established customer systems such as CCTV or ticketing and integrated train sensors, the software enables operators to take action to avoid overcrowding, or in case the limit of people allowed in a specific area, such as platforms, is reached.

The Capacity Solution can be adapted to meet operators' requirements but will typically provide insights from live or historical data to help tailor train schedules to improve passenger flow or to provide guidelines and generate instructions to passengers.

Amar Sansoa, technology manager for Siemens Mobility Limited, says: "Given that we all need to adhere to social distancing, we can flag it up at stations if people ignore it and then have an automated announcement broadcasted via screens and the PA system.

"All of the information that we collate on

“Our on-board technology offers the operator detailed insight into usage.”



**Simon Rennie,
Head of Digital,
Siemens Mobility**

passenger flow can also be circulated via passenger apps or to operator staff on handheld devices because we have such a wealth of data that can be interrogated and then relayed in a succinct and accurate manner."

To help reduce transmission and to reassure passengers on safety even further, Siemens Mobility also offers several other practical and innovative on-board solutions, including

custom-made 3D-printed parts to replace frequently touched surfaces on trains. They are made out of polymers which are easy to clean, install or remove.

Options to reduce the spread of viruses and bacteria include increasing fresh air volume flow rates and air filtration systems with HVAC. The company is additionally piloting an innovative fan with a decontamination chamber that uses a combination of photocatalytic coating and UVC light to remove pollutants, pathogens and CO2.

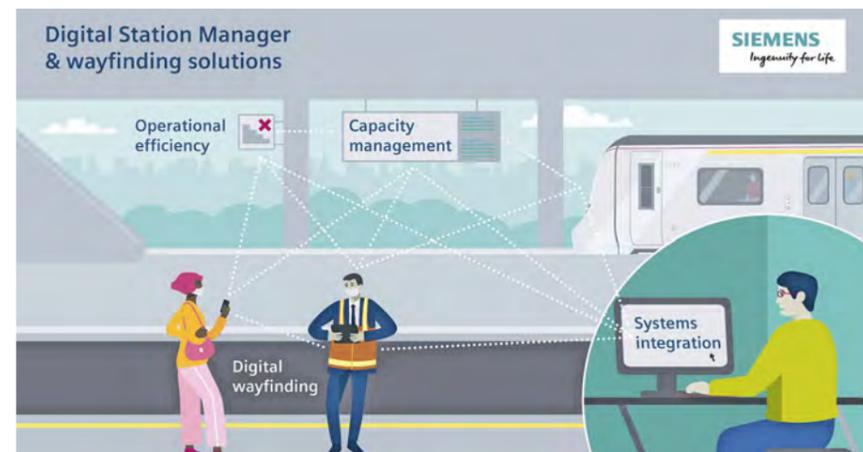
An active coating that can be applied to hard surfaces in driving cabs that prevents droplet based infection by providing continually sterilised surfaces, plus the use of UVC light, to rapidly disinfect surfaces using a handheld device is also on trial.

Siemens Mobility Limited Innovation Manager Lyndon Shaw says that the repurposing of pre-existing Siemens software, on-board and station technology to address some of the new challenges posed by coronavirus is testament to the versatility and flexibility of the company's product portfolio.

It is a portfolio that could go a long way in making us all feel much more confident when using the rail network.

He says: "We already had robust infrastructure and managing passenger flows was a key priority for us from an operational perspective. But we now have a different priority on top of that to maintain social distancing and we have been able to repurpose the analytics for a different business case.

"We could add things like thermal cameras to take passengers' temperatures or to connect with other devices like UV sanitisers on escalators to monitor that they are working, making sure we control the flow of people across the network with their safety at the forefront." ■



GREEN LIGHT

Siemens Mobility will be leading the charge in helping UK rail meet its net-zero emissions target by 2050, says RUTH HUMPHREY, JUSTIN MOSS and GRAEME CLARK



Rail has long been one of the most environmentally friendly modes of transport, but now it's set to become even greener.

That is because although it accounts for less than 1% of all the total UK annual greenhouse gas emissions, the industry has the tools at its disposal to eliminate almost all of its direct contribution.

As one of the first countries to establish a legally binding net-zero emissions target across the entire economy by 2050, the UK government has set a target for the rail industry to play its part by removing its largest single source of emissions – diesel-only trains – from the network by 2040.

Meanwhile, in Scotland, an even more ambitious target has been set to fully decarbonise passenger operations by 2035.

In order to achieve these targets, two documents were released earlier this year to set out the options and various pathways for the Department for Transport, Transport Scotland and Welsh Government to consider when making future funding decisions.

Transport Scotland published its Rail Services Decarbonisation Action Plan in July, while Network Rail released its interim Traction Decarbonisation Network Strategy in early September.

The two documents recommend the large-scale deployment of electrification, hydrogen and battery technology across the 62% of the

UK network that remains unelectrified.

Underpinning the recommendations is a 'decision tree' that has been developed using the various capabilities and cost implications of these three technologies.

That is because while they are all deemed sufficiently mature to replace diesel traction, not all are suitable for all types of rail services.

For example, in the strategy, Network Rail recommends that at least 11,700 single track kilometres (stk) should be electrified for powering long-distance high-speed passenger services and freight as these have higher energy requirements. The service frequency on these lines also strengthens the business case for erecting overhead line equipment

On the other hand, on less intensively used lines or where line speeds are lower, more than 1,300stk are deemed appropriate for hydrogen and battery-powered trains, which avoid the capital cost of electrification while providing the same reduction in direct emissions.

The challenge to remove diesel traction from freight is much greater, given that batteries

“The technology is proven and deliverable”

Graeme Clark, Head of Business Development Rolling Stock

and hydrogen cannot, currently, play any role. Nevertheless, NR believes that the target can be met to remove all diesel-only passenger trains from the network by 2040 and all forms of diesel passenger trains (including bi-mode) a decade later.

To develop these proposals, both NR and TS have worked collaboratively with the industry and companies like Siemens Mobility to gather evidence and leverage expertise.

Siemens Mobility has been highly supportive of the process and the ongoing work of the Rail Industry Decarbonisation Taskforce, in addition to the development of an overarching Transport Decarbonisation Plan by government that is due to be published by the end of the year.

Ruth Humphrey, Siemens Mobility's UKI head of business development and strategy says: “We chose to respond to the Government's transport decarbonisation consultation and have worked closely with NR and other organisations because we feel that it's a critical strategy and an important strand within our global business.

“It's important not just in terms of our responsibility to the environment, but because this is the way that our clients and customers are heading, and we want to help them as a leader in providing sustainable mobility solutions.

“In terms of rail we had already decided that it wasn't the right thing to be building new diesel fleets, so we've focused on electric traction, which is lighter, faster, more efficient and a more pleasant way of travelling. We've also looked at alternative traction and, on the infrastructure side of things, making the systems more cost-effective in order to encourage more electrification schemes to be pushed forward.”

Already a leading supplier to the UK of electric multiple units (including more than 1,100 vehicles for Thameslink's Class 700 fleet), Siemens Mobility now stands ready to offer other low-emission alternatives and will soon be offering its UK customers EMU fleets that can be part-powered by either batteries or hydrogen.

Battery technology is particularly advantageous. It can be fitted to either existing or new EMUs and will enable trains to utilise an overhead or third-rail AC supply where available, and to move independently of electrified infrastructure as required.

The company has therefore developed X-EMU 'eco' technology that can be charged



from an AC supply and then topped up through regenerative braking.

According to Siemens Mobility, this provides an X-EMU with a usable range of 80km when running on battery power alone, making it well suited to running on short unelectrified branch lines or in non-electrified sections.

X-EMU battery technology has already been fitted to the roof of a three-car Desiro ML Cityjet that entered passenger service with Austrian Federal Railways in August 2019, while there are also plans to convert a number of vehicles in this country in the near future.

Graeme Clark, head of rolling stock business development, explains: “We've been working on battery technology for a number of years and already have it operating in Austria where we are hoping to secure an order for additional trains very shortly. We've also secured an order from the State of Baden Wurttemberg for 20 Mireo eco battery EMU bi-modes together with a 29.5 year maintenance contract and guaranteed energy usage.

“But on parts of the network which look like they won't be electrified, a mixture of solutions will always be needed. Batteries only give us a range of 40-50 miles, so then you need to look at hydrogen fuel cells for distances greater than that.

“You've got to look at it from a system optimisation point of view and see it as a whole to provide the value and operational benefits, rather than selecting one system over another. Sometimes it will be hydrogen on its own, sometimes hydrogen or battery bi-modes working in conjunction with an electricity supply, and sometimes just a pure EMU, but we have to consider everything as a complete system in order to get the best outcome.”

“We've already got productionised fuel cell technology that has completed static testing, so we're starting from a good position”

Graeme Clark, Head of Business Development Rolling Stock

He adds: “The TDNS is a good lead into that and extols the virtues of each technology and how it can replace diesel which, apart from being dirty and noisy, has a high energy density and has always been quite a good way of propelling a train. Transport Scotland is even more advanced in its thinking and has a well developed strategy to remove diesel.”

For longer stretches of unelectrified track, Siemens Mobility has designed EMU fleets that are capable of incorporating hydrogen fuel cells. Emitting only water vapour, a new generation of hydrogen fuel cells has been developed by the company in partnership with Canadian manufacturer Ballard Power Systems to provide traction for Siemens Mobility's Mireo train platform.

Static testing has now been completed and a prototype is due to enter service on the European mainland in the next two years, before the technology becomes available to customers in the UK by 2024.

In addition to the onboard technology, Siemens Mobility will also be in a position to offer hydrogen manufacturing and fuelling facilities by leveraging the company's wider capability to also build the wind turbines and electrolysers that will facilitate production of the fuel using renewable energy sources.

Work on producing hydrogen from ammonia is also now under way - another method of creating the fuel that is expected to produce zero carbon unlike traditional industrial sources.

Clark adds: “We've already got productionised fuel cell technology that has completed static testing, so we're starting from a good position. Then it's about the production of the hydrogen, and Siemens is well advanced

Siemens Mobility's Sicat system (pictured here at Stevenage) reduces the cost of OLE by reducing the number of structures, requiring less track access and resources to install.

on how to do that.

“The first way is that we produce turbines and electrolysers. The second is that we're heavily involved in looking at ammonia technology.

“We can produce green ammonia which allows us to store between four and eight times as much hydrogen in a given space before cracking it to separate it into hydrogen and nitrogen. We've already proven the concept and now we're looking to move that into the pre-production phase to fuel a small set of vehicles on an experimental basis.”

Last but not least, in addition to developing alternative technology, Siemens Mobility is committed to reducing the costs of electrification in order to support its more widespread installation across the bulk of the unelectrified network as a prime method of reducing carbon emissions.

This is particularly important if the entire network is to have net-zero carbon, and diesel traction is removed from freight as well as passenger services.

Justin Moss, UKI head of electrification strategy for Siemens Mobility, explains: “You've got pockets of new electrification projects, such as Northern Powerhouse Rail and HS2, but no decisions have yet been made on a network-wide strategy. If you really want zero carbon then the whole network needs to be electrified.

“We are fully supportive of a rolling programme of electrification. However, we need to ensure it is procured in a consistent manner to avoid gaps. This should be more focused on output specifications to enable designers and manufacturers to focus on optimum delivery. We also need to look at this programme as a whole system rather than procuring piecemeal” ■



Siemens Mobility's Desiro ML OBB Cityjet eco electric-battery hybrid trains have been in passenger service with Austrian Federal Railways since August 2019.

INNOVATION STATION

Siemens Mobility's planned rail facility in Goole may still be three years away from completion, but the £200 million investment is already starting to drive change in the East Riding of Yorkshire.

Such is its significance to the local economy and the wider rail industry that none other than Prime Minister Boris Johnson opted to visit the 67-acre rail-connected site in July to mark the official start of construction.

The development of the site will be delivered in three main stages and will support up to 700 direct jobs, plus 250 during construction.

Once open in 2023, there will be an additional 1,700 supply chain opportunities.

Phase 1 comprises a three-storey office block and business centre which will be partly occupied by Siemens Mobility with procurement, logistics and engineering staff to support the company's wider UK business.

Space will also be provided for small and medium-sized enterprises, with a view to creating a 'railway village' collaboration area.

Phase 2 is being delivered in collaboration with the Birmingham Centre for Railway Research and Education (BCRRE) on behalf of UKRRIN (the UK Rail Research and Innovation Network) which brings together the rail industry, supply chain and academia to

These apprentices including Milly Johnston (far left) and Kate Rodley (second right) are among the first of up to 700 employees who will work at Siemens Mobility's Goole rail facility when it opens in 2023.



Finbarr Dowling, project director for Siemens Mobility's £200 million investment in Goole, tells **RAIL** how the company has set about creating more than just a train building factory



accelerate new products to market.

A £6m building will be the headquarters of RaisE (Rail Accelerator and Innovative Solutions Hub for Enterprise) with a key focus on providing research and development support.

Both phases 1 and 2 will complement Phase 3 at Goole, which is the construction of a new factory that will start life by delivering a £1.5bn contract to manufacture 94 trains for London Underground's Piccadilly line.

Siemens Mobility Project Director Finbarr Dowling explains: "On the main plot we are starting with the factory that will assemble the new Piccadilly line trains from 2023. The enabling works continue and the main contractor will be announced imminently with full works to commence in October this year.

"But we are also looking at how to maximise warehousing and logistics through some of our suppliers co-locating and we're also collaborating with a number of partners on innovation under the banner of RaisE, which will be formally launched soon.

"RaisE is a collaboration with BCRRE with the idea to create an innovation centre that has links with phases 1 and 3 to focus on digital-related projects in the industry. These will include using data analytics to power the 21st-century railway in the UK, using robotics, and also augmented reality and artificial intelligence.

"Those facilities will be open to anybody from the supply chain and we're always looking at new ideas, so it's a great opportunity and really for our imagination to fill it. Goole will be a lot more than just a factory for building trains."

The site at Goole was chosen not just owing to its rail connection and close links to the motorway network, but also for the ports on the Humber and both Doncaster/Sheffield and Leeds/Bradford airports.

The company already has a large presence across the north of England and particularly in nearby Hull, where Siemens has previously invested more than £300m and created 1,000 jobs at a new offshore wind blade

manufacturing, harbour and service facility.

Siemens Mobility also has Train Maintenance Depots in Leeds and York and opened a new Bogie Service Centre in Lincoln in November 2018.

"My team and I have a lot of experience in terms of what can be achieved in the region and good connections with local governance and the key players in the area," adds Dowling.

"We know it's easy to work with these people so opting for Goole was a combination of local commitment, physical connectivity and the strong tradition we have in the area. We're very familiar with the type of skills here and are very happy with the quality of education that's being provided in the area."

One education provider that the company has developed close links with is Selby College, which is Siemens Mobility's chosen training partner for Goole.

The first cohort of 12 apprentices was welcomed on September 15 by Selby College, where they will undertake a Level 3 Rail Apprenticeship programme.

The new starters – who were selected from over 200 applicants – will spend the first year at the college to develop core engineering knowledge and competencies, and in the second year will spend one day a week at the college and the remaining four on placement at Siemens Mobility traincare facilities.

Their third year will be split between working full time at the Goole facility and a six-month placement at the company's rolling stock facility in Vienna.



An artist's impression of the Goole facility where 94 trains will be constructed for London Underground's Piccadilly line.

APPRENTICE PROFILES



Milly Johnston

Milly (18) had begun a car mechanic apprenticeship at a local garage in Goole, but it came to a premature end when the business ceased trading. Undeterred, she

kept looking for opportunities to work at Siemens Mobility's Goole plant by regularly checking the website for apprenticeships.

She says: "This is brilliant for Goole because Siemens Mobility is such a big company and there isn't anything like it in this area. It will create a lot of new jobs, bring more people into the town and encourage people to relocate to the area. It was interesting to meet Boris Johnson and it was good that he visited."



Kate Rodley

Kate (18) says that she knew that she wanted to work for Siemens Mobility since the age of 14, when she took part in an electric kit car race at Beverley

High School in East Yorkshire organised by Greenpower Education Trust and supported by Siemens.

Now, after gaining a double distinction in engineering at Ron Dearing University Technical College in Hull, Kate's ambition has been realised.

She adds: "I'm so excited to start my career and looking forward to entering an adult environment, being practical and independent, while with the other apprentices. The apprenticeship offers travel opportunities too, which is also exciting."

DIGITAL RAILWAY

Head of Digital for Siemens Mobility SIMON RENNIE and Operations Director for Digital Railway MARK FERRER explain what benefits intelligent rail systems are bringing for passengers and the wider industry



The entry into service of the first Class 700 with Govia Thameslink Railway in June 2016 heralded the start of a new era for rail travel in the UK.

Making that maiden journey was 12-car 700108, which was procured in 2013 as part of a 115-train order for the government-sponsored Thameslink programme.

But as well as being part of one of the largest ever train orders in UK history (worth some £1.5bn), it also marked an important step in the evolution of Siemens Mobility's Desiro City platform.

The '700' had been offered by the company following an extensive research and development programme, during which more than 50 million euros was spent to create a bespoke solution for the Thameslink programme.

Siemens Mobility's engineers needed to fulfil a demanding specification to not only increase capacity to carry an additional 50,000 passengers into central London per day, but to also improve safety, security, comfort, cost and energy efficiency.

The '700s' also had to be fully digitally enabled to integrate with new infrastructure, becoming the first main line trains in the world to operate using both ATO (Automatic Train Operation) and ETCS (European Train Control System) in-cab signalling technology.

The train's intelligent software design also offered other benefits, including increased reliability and performance through data-driven technology.

Head of Digital for Siemens Mobility Simon Rennie explains: "The Class 700 is the first of a new generation of digital trains. It transmits more than 100,000 different data sets in real time that tell you key things such as the condition of the train, its occupancy and levels of passenger comfort."

The installation of thousands of data-gathering sensors in each vehicle means that diagnostic data is streamed from each train to Siemens Mobility's service centre, enabling preventative action to be scheduled while the train is still in service, and a new regime of predictive maintenance to operate at Thameslink's two depots at Hornsey and Three Bridges.

Rennie adds: "It represents a colossal change because your maintenance regime is more

finely tuned to the condition of the train, giving you better reliability and availability."

To help manage and understand the 'big data' produced by the Desiro City and other Siemens Mobility train platforms, the company offers operators access to its Railigent cloud-based mobile application suite.

Part of the MindSphere Internet of Things (IoT) family, Railigent can integrate with various applications which are then analysed and interpreted through a simplified dashboard.

Rennie says: "Railigent's core function allows us to predict when routine maintenance is required so you can optimise when you do it without necessarily taking trains out of service."

Siemens Mobility is also committed to continuous improvement. Just like a smartphone, the software on Desiro City trains is continually updated during its lifetime.

The Class 700's compatibility with ETCS and ATO has also improved the passenger experience and increased reliability and performance.

Not only does in-cab signalling increase the number of available train paths through central London by enabling trains to run much closer together, but it can also be integrated with a traffic management system (TMS) to help keep performance as close as possible to the timetabled path of each train.

Traffic management systems are currently being rolled out across a wider area than the Thameslink core in central London (approximately 20 minutes' travel time in each direction), while Network Rail has also commenced a programme to install ETCS

and traffic management on the southern portion of the East Coast Main Line between Peterborough and King's Cross.

Operations Director for Digital Railway Mark Ferrer says: "When you look at the railway itself, it is a system and the train is a part of that, alongside the infrastructure and operation. In order to get the best out of a train like the '700' that has so much onboard automation, you need to facilitate that from the trackside, such as the ability to automatically control trains and provide protection.

"Rather than being something that uses the railway, the trains become an integral part of the system itself."

Away from areas that have ATO, driver advisory systems can be connected with traffic management systems to help trains keep to time.

The resultant Connected Driver Advisory System (C-DAS) can be viewed as two subsystems, with the TMS defining timetable requirements in real time and the Driver Advisory System providing information to the driver to stay within the timing requirements.

Advantages of C-DAS include; fewer stops at red signals, improved train regulation, lower energy consumption and reduced wear and tear on rolling stock.

Ferrer explains: "Driver advisory systems are pretty static in that it takes a timetable and says 'this is the diagram of this train and this is the time it's got to be there'. If the performance of the railway degrades throughout the day, there is no real way for drivers to understand the impact of that along the route.

"By coupling DAS up with the signalling control centre (C-DAS) then we can then start to advise through traffic management how

drivers should drive trains by giving them more information on the route ahead.

"As an industry, we want to iron out performance issues and we now have the tools and capabilities to do that as the day progresses and things happen. With traffic management and ETCS combined with C-DAS there is now an option to maximise the capability of the railway and dynamically advise drivers of the constraints of the railway ahead leading to a much more efficient operation." ■

