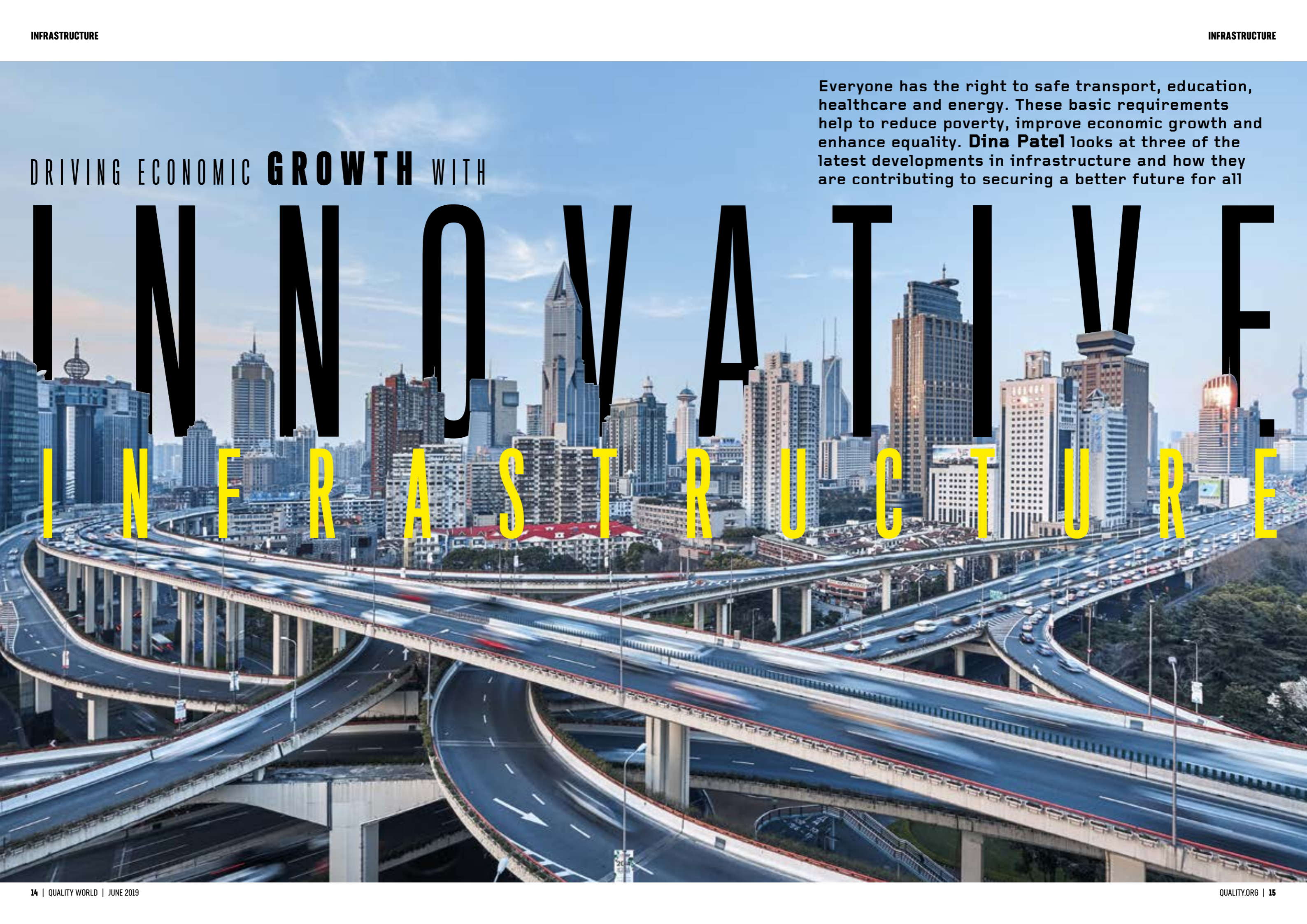


DRIVING ECONOMIC **GROWTH** WITH

Everyone has the right to safe transport, education, healthcare and energy. These basic requirements help to reduce poverty, improve economic growth and enhance equality. **Dina Patel** looks at three of the latest developments in infrastructure and how they are contributing to securing a better future for all

# INNOVATIVE INFRASTRUCTURE





**I**n 2015, the United Nations created 17 Sustainable Development Goals to be reached by all countries by 2030, one of which is building resilient infrastructure. The UN believes these goals are the blueprint to achieving a more sustainable future for all. *Quality World* speaks to Joanne Cox, PCQI, Head of Quality Asia Pacific for Bombardier Transportation's Rail Control Solutions division, Edwin Henry, PCQI, Quality Assurance and Quality Control Engineer in the Middle East, and the Finnish team behind autonomous vehicle Sensible 4 to find out how they're investing in innovative infrastructure. Richard Clegg, Chief Executive at Lloyd's Register Foundation, also talks about the challenges facing the infrastructure sector.

**T H A I L A N D**

Joanne Cox is the Head of Quality for the Asia Pacific region for Rail Control Solutions – the rail signalling division of Bombardier Transportation. She has a team of 11 people working in project quality assurance across the region. Prior to taking up her current role, based in Bangkok, she had worked on mainly UK-based rail infrastructure projects for 12 years.

**QW: What projects are you currently working on?**

**JC:** We've got some really exciting projects in Thailand. We're working on three new mass transit lines in Bangkok. The first is to provide a turnkey rail system for the city's new Pink and Yellow lines. These are Thailand's first two monorails. We are also equipping the Gold line, another addition to Bangkok's mass transit network, and we are completing work on the signalling and system integration for extensions to the city's elevated, rapid transit Skytrain Sukhumvit line.

Among others, we are also working on rail control projects in Melbourne, Australia, two projects in India and

one in Malaysia's Klang Valley/Greater Kuala Lumpur area, which support the transport of millions of people.

**QW: What does Bangkok's Pink and Yellow lines project involve?**

**JC:** In 2017, Bombardier signed the contracts to deliver its full turnkey Bombardier Innovia Monorail 300 systems, comprising a total of 64.9 km of line and 72 four-car trains equipped with Bombardier CityFlo 650 automatic train control technology.

In addition, we will provide 20 years of maintenance services for the vehicles, guideway switches and depot equipment. My scope is focused on the systems integration and signalling as part of these contracts.

**QW: What role does quality play in this project?**

**JC:** The quality team for this project includes a project quality manager who oversees quality assurance, and we have specific quality engineers who oversee manufacturing and installation to make sure the work is in line with requirements. The project quality assurance specialist coordinates site reviews, audits and inspections, and supports the quality manager.

**"BANGKOK IS BUSTLING. IT'S REALLY THRIVING AT THE MOMENT...THE PROJECTS WE ARE WORKING ON WILL BENEFIT BUSINESSES AND THE ECONOMY"**

Right: Bombardier will maintain the Innovia monorail 300 system in Bangkok

Below: Joanne Cox, Head of Quality for the Asia Pacific region for Rail Control Solutions - Bombardier



Image: iStock

Bombardier implements the 'Quality is Boss' initiative, which is about empowering managers to put quality first on all projects. This campaign is enabling not just management, but also administrators, engineers and project managers, to be involved in quality. We use the eight disciplines (8D) model – a quality tool to help quickly analyse and understand any issues, determine the root cause, how to contain the issue and share any learning. We train all of our core staff in the 8D process, so they are able to undertake 8D analysis. Our region is certified to the ISO 9001:2015 Quality Management standard and the International Railway Industry Standard, and we have the ISO 14001 Environmental Management and ISO 18001 Occupational Health and Safety certifications. I have an amazing team member who looks after certifications and she works with our quality managers and function heads to make sure

the audits are planned accordingly.  
**QW: What have been the main challenges for you?**

**JC:** For me, it's the different time zones, because team meetings can be early in the morning or late in the evening.

Our team is really diverse. I have many women in my team, which is completely different for me as it's normally the other way around. We have different nationalities, languages, ages and competencies.

We have regular meetings to share our achievements and challenges. Ensuring the quality managers help the project capture the contractual quality requirements right first time to prevent any re-work or missed opportunities is also a challenge.

Good communication between all parties and the quality responsible in that team is vital to achieving this. Each project is different, and by sharing that knowledge we can improve quality.

**QW: How do these projects benefit Bangkok?**

**JC:** Upgrades to the mass transit network and the new lines that are under construction are a really important part of the investment programme underway to increase connectivity across Bangkok, bringing public transportation to new areas of the city. The new monorail lines expect to benefit over 400,000 passengers daily. The Skytrain carries over 750,000 passengers a day already, and a new 13km section of the line is expected to enable up to 100,000 more journeys on the system.

Bangkok is bustling. It's really thriving at the moment, not just from a tourism perspective, but from a business perspective as well. The projects we are working on will benefit businesses and the economy – allowing residents on the outskirts of the city to be connected and helping more people to gain access to jobs and education. Some commuters travel in to Bangkok and stay in the city during the week because it's easier than travelling in and out every day. Enabling people to get home to their families at the end of the day will be an amazing opportunity. ■

**M I D D L E E A S T**

Edwin Henry is a quality assurance and a quality control engineer at a government body in the Middle East. He is responsible for ensuring the quality of service and products used and procedures adopted by his organisation are in accordance with policy requirements, national and international ►



**“WE ARE ENTERING THIS FOURTH INDUSTRIAL REVOLUTION, WHICH IS GOING TO BRING A WHOLE NEW WAY OF THINKING ABOUT INFRASTRUCTURE”**

standards and specifications.

**QW: What is your organisation responsible for?**

**EH:** The company I work for was established 15 years ago and supports the development of infrastructure projects in the Middle East. My organisation has strategic partnerships with global establishments that will bring capacity and capabilities to ensure we are the most developed nation in the infrastructure sector. With high aspirations for the future, we are committed to undertaking infrastructure developments that will support the future growth in the Middle East. We operate in alignment with our corporate strategy, which outlines our direction and the operational procedures which need to be followed in order to achieve our mission and vision. In line with the strategy and objectives, my organisation works to deliver projects that implement the best practices in infrastructure development and management.

**QW: How are you using quality to implement the best practices in infrastructure development and management?**

**EH:** My organisation established a working group with multiple contractors to undertake work related to improving infrastructure. I am a part of the working group team, which formed to escalate the new changes, and I am responsible for the new change management. I am representing quality by providing advice to the committee and by understanding all stakeholder product and service. In terms of understanding customer and stakeholder needs, and the performance of a new product, I have implemented regular site surveillance as a tool to evaluate the performance of our in-house contractors and suppliers. By using these tools and techniques, I am able to monitor and control the physical work and services that are carried out in accordance to the requirements and in line with our strategy. At the end of each site surveillance, a comprehensive report is issued evaluating the visit with observations, a non-conformity report and recommendations. This is how I maintain quality in my organisation. ■



**Richard Clegg, Chief Executive at Lloyd's Register Foundation, explains to QW what resilience means to the infrastructure industry**

**QW: What are some of the challenges currently facing infrastructure?**

**RC:** We are entering this fourth industrial revolution, which is going to bring a whole new way of thinking about infrastructure – for example, advanced manufacturing techniques like 3D printing. Infrastructure is going to be very complex and interconnected through the Internet of things (IoT), global supply chains, and while it brings a lot of benefits, it brings risks as well, such as cyber security. The world is becoming more complex and infrastructure is now made up of embedded systems, components and materials that are connected in ways that we haven't got any experience of. Autonomous vehicles for example, is a whole new area. How do we regulate this sort of technology? Like a lot of things, if the technology comes too quickly, society won't have the time to adjust to it. Change is good as long as it is progressive and happens at the right pace.

**QW: How should organisations be seizing these opportunities?**

**RC:** I think the types of challenges that organisations are facing are to do with skills and education. These technologies – autonomous technologies, artificial intelligence and advanced manufacturing techniques – require new skills. Importantly, that's not just the skills of the workforce, but also the skills at board level. Boards need to recognise that there are technology-related risks.

**QW: How can we ensure that what is built today will be environmentally sustainable tomorrow?**

**RC:** Environmental sustainability looks at the complete lifecycle view of infrastructure. Where did the materials come from? During its operation, what is its impact going to be? Then when it comes to decommissioning

and recycling or even extending the life of this infrastructure, what's going to happen to it once it is, essentially, put back into the environment?

We really have no understanding of how some of these materials perform when they're decommissioned, disposed of, or recycled. Somebody told me that one of the biggest hazards the UK is beginning to face is recycling things like flat-screen televisions. We've never had to do it before, and so scrapyards smash them up and it releases things that we have no experience of.

**QW: How can the infrastructure industry improve resilience?**

**RC:** Resilience is the ability to absorb a stress – say an extreme natural weather event, a malfunction, an economic stress, or a terrorist stress – bounce back and recover functionality. I think resilience can be improved in two ways. One is to talk across sectors. A lot of work has been done on creating resilient cities and tools, techniques and methodologies are being developed. That learning could be applied to resilient infrastructure. There is a lot of cross-sharing to be done and learning from different experiences.

**QW: What can the quality profession do to play a key role in creating resilience?**

**RC:** Quality professionals gather data from using different methodologies, standards and codes. They need to maintain the quality of that data. Board members and non-executive directors also need to be educated on how to conduct a quality assessment.

**QW: What does the future of infrastructure look like?**

**RC:** You can get very science-fictional about this and there are lots of myths. However, infrastructure is going to be intelligent and it's going to be made of materials that have fascinating properties. They may be self-healing, self-repairing, self-monitoring, and they'll be predicting what's going to happen.

They're also going to be interconnected. I don't think we'll have isolated pieces of infrastructure any longer – infrastructure is going to be joined up. For example, bridges around the world will learn from each other. It all boils down to the Internet of things and connectivity – but we have this great opportunity to have smarter and safer infrastructure.

**F I N L A N D**

The Finnish Transport Agency's intelligent road E8 Aurora has been opened, and testers from all over the world can use it to try out new technology in the fields of automated driving and infrastructure.

Completed in 2017, the 10km intelligent road section runs from Pahtonen to Puthaanranta in Finland, an area that experiences harsh winter conditions. This offers the opportunity to test intelligent transport systems and proactive road condition management by providing the supporting physical infrastructure and data services.

“Now we can see how automated driving affects the road network and the demands this places on winter road maintenance,” says Reija Viinanen, Director of Aurora Collaboration.

One company testing its prototype is Sensible 4, a Finnish software start-up specialising in self-driving vehicle solutions. The self-driving software developed by the start-up enables all types of vehicles to operate all-year round in different driving environments. The Gacha vehicle, designed with Muji and powered by Sensible 4's self-driving software, can be fully integrated in existing public transportation systems, taking people to work and school. The technology involves lidars, radars, 360-degree camera vision and high precision GPS.

The company set out to make autonomous mobility possible in harsh Finnish winter conditions. “The Finnish transportation authorities have been very supportive by enabling us to test and develop in open-road as well as keeping us up-to-date on how the legal situation is developing in the EU and worldwide”, says Harri Santamala, CEO at Sensible 4.

E8 Aurora provides the physical and digital infrastructure to serve the needs of high-performance future transportation and has been used to check in real life that Gacha will work safely and securely in all conditions. Santamala comments: “Safety is always our highest priority. Taking a new vehicle from a closed testing area to the open-road obviously needs a lot of attention to identify

any potential risks. Sometimes the general public is expecting too much too soon, while demanding a high level of safety. Industry should be able to take things slowly to make sure we meet the safety expectations. We have met these challenges with enough testing, constantly carrying out risk assessments and maintaining human supervision during the testing.”

The future benefits of Gacha include providing affordable and accessible transportation services to the public and it could be rolled out globally, not just for places and countries with extreme weather conditions. Finland now needs to focus on the connectivity of its traffic lights to support autonomous driving, suggests Santamala. ■

Below: Gacha's capacity for passengers is 10 seats and six standing, with a maximum speed of 40km/h when driving in autonomous mode

