

THE INTELLIGENT, PEOPLE-CENTRIC RAILWAY

SANJEEV RATHI, DOMINIC TAYLOR and JULIE CARRIER of SYSTRA describe how the technology of today has reached a critical mass, enabling the creation of the railway of tomorrow

Urbanisation, population growth and the continuously changing socio-economic landscape have led transport planners around the world to work towards integrated transport systems, in which the railway plays a key part.

Commuting is linked to economic growth and has an impact on both work and social life. Despite investment in new railway infrastructure, the challenge remains of trying to beat extended rush hours and making trains efficient “mobile offices”. The end user’s relationship with railway infrastructure is not a good one, with delayed and cancelled trains often blamed on overrunning engineering works, failure of asset(s), etc.

When things go wrong, the passenger relies on the quality of information received, whether that’s on the train or while waiting at the station. It is the responsibility of transport planners, engineers, infrastructure owners and operators to provide a seamless experience for the end user by designing and building infrastructure that offers a reliable journey, guaranteed to satisfy modern-day expectations. This article considers the whole-journey experience of a passenger and what is being done to improve it by harnessing the power of modern technology, data and

infrastructure design.

The passenger experience starts with planning a trip and invariably involves various modes of transport, considering journey times and buying the ticket, or tickets. This is very different from 20 years ago, as these activities can be carried out from any Internet-connected device supported by sophisticated search tools. Smart ticketing has the potential to further revolutionise this crucial part of the journey. It will also enable the dynamic regulation of ticket prices, which in turn will help regulate customer demand to better align with the available supply of train seats. This will provide better value for money for the passenger and enable an improved journey experience by incentivizing travel on less busy services.

Smart ticketing and electronic tracking of individual passenger journeys will enable passengers to be kept more up-to-date about changes to their journeys. The technology allows passengers to be compensated automatically in the event of any disruption. Furthermore, it will provide valuable data to enable operators to analyse people’s travel behaviours, identify customer preferences, understand daily needs and ultimately provide

a better service.

Sanjeev Rathi, SYSTRA’s UK Systems Engineering Manager says: “For most passengers, end-to-end journeys remain a conglomerate of small journeys by rail plus multiple other transport modes, rather than the seamless experience they might experience when travelling by car. Smart ticketing and integrated journey planning apps will make it possible to have one seamless transaction for the whole journey. Imagine buying just one ticket that covers taxi transfer to your local railway station, all the train journeys and onward travel via bus/metro, and to have it all planned and managed on your behalf with regular updates on changes, plus automatic compensation if you’re delayed.”

During journeys, stations are a key interaction point for the passenger. Moving through a busy station can be a stressful experience, but technology and thoughtful design can mitigate this. Good visual continuity, open spaces, ambient light, ventilation and accessible passenger information systems, in unison with well-planned retail and ergonomic consideration



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of how passengers interact with the station environment, makes for a more pleasant passenger experience.

To facilitate this, SYSTRA pioneered the SMART Station concept to make the station an interactive living space and a more pleasant part of the passenger journey. The SMART Station concept is an interactive tool that allows station operators to control the station environment in real time to improve passenger experience and reduce operation and maintenance costs.

Indoor and outdoor sensors collect data on the colour and intensity of the light, plus temperature, noise levels, ventilation performance and the number and location of people in the station. The controller can choose different pre-defined settings to adjust the lighting, air-conditioning, public address systems and information panels according to the needs of the passengers.

The connected station brings technological innovations like smart screen doors, smart lighting and digital and dynamic signs to improve daily operations and reduce energy consumption, making the journey more intuitive for passengers and reducing maintenance costs, as sensors can also be used to assess the station’s critical equipment.

This concept has been developed collaboratively with end users, architects and engineers, and data collected can be used to inform the infrastructure design of the station. This method has been successfully used for underground stations on Line 11 - the Paris Metro extension.

Director Julie Carrier adds: “The next evolution of the concept is to link the SMART Station with passenger health data, collected through wearable technology, to measure stress levels. This will allow the controller to intervene remotely to make the journey experience as pleasant as possible without the passenger being aware of it.”

Exploiting today’s digital signalling technology to monitor, predict and manage train running can enable passengers to be

presented with more accurate information about their journey and to plan accordingly. Smart ticketing gate lines can be dynamically reconfigured using passenger flow data to enable speedier passenger flow. SYSTRA has been working with Translink in Northern Ireland to develop this technology.

For the train journey itself, progress has been made in terms of more frequent train services and shorter journey times. Infrastructure and technology have played an unseen role in enabling these improvements, including bridge strengthening, track alignment improvement, longer trains and platforms, and signalling upgrades to improve capacity and reduce journey time. Combining modern digital technology (such as ETCS, TMS) with infrastructure alterations enables trains to run closer together (creating paths for more services) and faster (to improve journey times). To the passenger this means more flexibility over when they can travel, less time waiting for a train and less time spent getting to their destination.

The passenger experience is determined not only by the speed and frequency of the planned service but also how reliably that service can be delivered. Providing reliable and dependable transport means not only designing and building assets to the required standards but also keeping them in a maintainable condition.

While the assets are getting older and mobility needs are increasing, there is an accelerating effect on asset degradation. As operational constraints and limited maintenance access remain a challenge for asset management, use of digital technologies and data is being used to monitor assets’ actual condition in real time.

The concept of smart rail infrastructure is developing quickly, boosted by innovation from the Internet of Things (IoT) and sensor technology. Obtaining data from physical assets presents a major opportunity to enhance the knowledge of mass transit and rail assets. For example, creating a digital

replica of the railway assets using Building Information Modelling (BIM) and Geographical Information Systems (GIS) techniques, and using this data to plan maintenance.

SYSTRA is currently assisting SNCF Réseau, France’s national railway infrastructure manager, in asset management using BIM data to deliver the EOLE project in the Paris region. Although BIM is becoming a ‘must-have’ on greenfield railway projects, this modelling solution is not the only method of digitizing the assets. GIS, combined with a data lake (system or repository of data stored in its natural format) can be a relevant alternative, particularly for existing networks.

In 2017, Chile’s national railway company appointed SYSTRA to prepare a digital replica of their existing assets in a common data environment register.

“The use of Smart infrastructure with intelligent asset condition monitoring can predict failures before they occur,” says Dominic Taylor, Technical Head of Systems and Signalling. “As far as the passenger is concerned, this means a more dependable railway service that is open for business when it is needed.”

By predicting when maintenance is needed, trains and other critical assets do not have to be taken out of service and the need for repairs should be significantly reduced. In addition, with real-time data, maintenance teams will constantly be updated on the state of the assets and the asset management system can provide early warning of faults. SYSTRA is developing the Smart rail infrastructure concept using advanced data-analytic tools and the innovative Internet of Things (IoT), along with sensor technology, to help in reducing lifecycle costs and increasing asset reliability during operation.

During the actual journey, establishing what is most important to passengers is crucial to ensuring they receive the most appropriate on-train service package. Considerations include comfort of seats/legroom, on-board catering, power sockets/WiFi, luggage space and so on, the relative importance of which vary according to the type of journey and the individual. Customer feedback and data will help to make sure the right service packages are provided.

Passengers remember when things go wrong, and these are also the occasions when the railway hits the headlines. Investment in infrastructure and predictive asset management will help to avoid this. Modern digital traffic management systems can optimise services and facilitate faster recovery of normal operation, minimizing the adverse impact on passengers when lines are blocked or operating at reduced speed/capacity.

Sharing data from digital systems and using modern communication technology will enable passengers to be kept better informed during disruptions and allow them to efficiently plan alternatives. Smart ticketing will enable quick, automated identification of passengers inconvenienced by disruption so that they can be appropriately compensated.

SYSTRA is working with customers around the world to provide people-centric, intelligent rail solutions at every stage of their journeys. ■



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