TRACKTALK

RAILWAYS COMMUNICATIONS E-ZINE

ENHANCE THE PASSENGER EXPERIENCE

Today's railway passengers expect not only a comfortable seat, but the ability to work, and access real-time information on board a train. Our expectations of mobility mean the journey to and from the station should also be a pleasant and seamless experience. Information must be readily available and platform and departure times clearly displayed.

Rail's ability to provide unsurpassed passenger comfort gives it a distinct advantage over other modes and this offers operators a unique selling point for their product.

Providing an optimal passengers experience is now a crucial consideration, and is the subject of this newsletter.

These four articles compile four distinguished perspectives from industry experts on this topic. From an academic's insights into what causes anxiety in passenger to what journey experience is currently like for international travelers in Europe and how it can be improved.

Recent technological developments offer not only the opportunity to improve

communications for the benefit of passengers, but also a chance to generate new sources of revenue. This issue of TrackTalk looks at the economic basis for introducing new passenger technologies, and how to develop a business case.

It is clear that greater consideration for improving passenger experience and offering services that previously seemed unattainable is driving innovation in a vibrant sector of the railway industry. Suppliers are doing all they can to keep up with the modern day passenger's demands, to such an extent that it is no longer a question of if operators will get on board with these developments, but when.

SUBSCRIBE: www.alcatel-lucent.com/blogs/tracktalk/

CONTACT: olivier.andre@alcatel-lucent.com

VISIT: www.alcatel-lucent.com/railways

Alcatel·Lucent

AT THE SPEED OF IDEAS™

ADDRESSING PASSENGER ANXIETY

BY: DR YUNG-HSIANG CHENG, ASSISTANT PROFESSOR OF TRANSPORTATION AND COMMUNICATION SCIENCE, NATIONAL CHENG KUNG UNIVERSITY, TAIWAN

HIGHLIGHTS

- Crowded stations, delays, and locating and getting to the correct platform are the primary causes of passenger anxiety

- Increasing train frequency, providing accurate signage and appropriate climate control and entertainment systems can all help to reduce anxiety

- Reducing anxiety will make passengers more receptive to using the train and more likely to leave the car at home

Despite possessing strong and cheap public transport links through extensive bus and rail networks, cars and motorcycles remain the most popular mode of transport in Taiwan. The public, it seems, would rather battle through the congested streets in their own vehicles than use public transport.

Attempting to understand why this is the case is the subject of research by Dr Yung-Hsiang Cheng, an associate professor in the Department of Transportation and Communication Science at Taiwan's National Cheng Kung University. In his work Cheng considers the impact that anxiety has on passengers' transport choices and ultimately concludes that in the case of Taiwan the stress and strain associated with train travel is enough to make the majority of the public choose alternative means of transport.

Crowded stations, delays to service and the time taken to identify and get to the right platform at the right time are all factors that are contributing to increases in passenger anxiety and according to Cheng are putting people off using the train.

"We aimed to analyse every stage of the journey – from when passengers enter the station to when they reach their final destination – and what factors are affecting passenger anxiety levels," Cheng says. "To achieve this we applied the Rasch psychological model to analyse and measure anxiety at different stages of a journey which has helped to identify the main reasons for resistance to using public transport and also help to suggest ways in which operators can make improvements to optimise passenger environment and also the travel experience."

INADEQUATE INFORMATION EQUALS INCREASED ANXIETY

The findings are based on the results from a survey conducted among 412 passengers, 52% of whom were male and 48% female, with an average age of 25 years. These passengers used the train on average 3.72 times per month and were asked questions relating to passenger environment such as seat availability, passenger information, the gap between the train and the platform and train delay. The results subsequently identified crowding as the greatest form of anxiety experienced during train travel followed by delays to journeys.

In crowded situations Cheng reports that passengers are likely to become more anxious because they are uncertain of their surroundings and can perceive a crowded environment as being a threat to their health and wellbeing. Delays to journeys cause anxiety because of the time spent at stations and onboard trains which leads to uncertainty of making connections, a factor that is increased when there is inadequate information from passenger information displays and announcements.

The survey also ranked the accessibility of platforms at stations, the availability of platform location information and the ease of transfer between different trains as the other main causes of passenger anxiety. However, Cheng says that levels of anxiety experienced can vary.

"We have found that there are significant differences between the levels of anxiety experienced by different types of passengers, particularly between long distance and commuters." Cheng says. "Commuters, because they ride the train almost every day to get to work and are used to the travel conditions are inevitably going to have less anxiety than long distance passengers who are using the train for leisure purposes."

Another perceptive difference was the distance between the train and the platform edge. Cheng says that the various types of rolling stock used on the Taiwanese network mean that passengers are often required to step up onto some trains or traverse a large gap between the platform and the coach. Those familiar with train travel might become more used to this, but for infrequent travellers it causes concern.

<   SOCIAL VIEW   >

RECOMMENDED SOLUTIONS

Among the solutions that Cheng recommends is that the height of passenger coach doors on any trains procured in the future matches the height of the platform. He also points out that increasing train frequency will help alleviate anxiety associated with crowding and delays by offering passengers more options.

"Increasing train frequency by providing more system capacity is a clear solution to these problems," Cheng says. "Obviously the cost of adding more trains is the responsibility of the railway but more trains do equate to a better service so if you want to reduce passenger anxiety you will have to pay a lot more money."

While these are considered the primary solutions to alleviating the anxiety experienced by Taiwan's railway passengers, Cheng says that railway operators can also improve passenger experience by introducing a series of measures that he feels are relevant to providing effective railway services all over the world.

Improving accessibility to railway stations by allocating more space for car parks can increase the attractiveness of the train as a single element of a multi-modal journey. Another extremely important consideration is the ability to provide accurate, clear and regularly updated information on digital signage, passenger information systems (PIS), all visual displays and public address systems in the station, and on board trains. By publisizing platform location and reasons for delays and subsequent alterations to journeys and connections passenger anxiety can be reduced.

Training staff to be responsive to passenger's concerns is also an important consideration.

"How they respond to certain situations can go a long way to alleviating concern," Cheng says. "By acting in a calm and polite manner and providing clear and coherent information that addresses passenger enquiries, anxiety can be reduced."

Inevitably train comfort is a major contributor to the anxiety levels experienced by passengers during journeys. The ability to control the temperature of the train through air conditioning and heating systems is therefore crucial, particularly during instances of overcrowding.

DIFFERENT NEEDS

As for entertainment systems on board trains, Cheng says these can help to improve the passenger environment and make train travel a more pleasant experience, but the benefits again vary depending on the type of journey. Long distance passengers can have very different needs to passengers who spend just a few minutes on a train.

"We need to understand the characteristics of certain passengers to know what kind of entertainment to provide," he says. "I can see services such as WiFi being very useful to business passengers who can keep up with work on the move. But entertainment can suit other passengers as well. I was recently on a train in Japan which had passenger information onboard trains as well as advertising and programming. It seemed to distract the attention of passengers and could be a solution to reduce anxiety during delays."

While crowding and delays are likely to remain synonymous with rail travel, particularly during peak times, it is clear steps can be taken to reduce their impact on passengers' journey experience. As Cheng's research indicates efforts to alleviate anxiety at every possible stage of the journey should be a major consideration for railway operators. By addressing these concerns he indicates that the appeal of train travel will only improve meaning that in Taiwan and elsewhere across the world leaving the car at home will become a much easier choice to make.

I was recently on a train in Japan which had passenger information onboard trains as well as advertising and programming. It seemed to distract the attention of passengers and could be a solution to reduce anxiety during delays.

MAKING THE CASE FOR NEW PASSENGER TECHNOLOGIES

BY: CHRIS BAKER, INTERFLEET TECHNOLOGY; STEPHEN RADFORD, INTERFLEET TECHNOLOGY

HIGHLIGHTS

- **Onboard communications generally makes a strong business case**
- **Retrofitting passenger information systems to older trains can be an economic challenge for operators Scheduling**
- **installation of new systems to coincide with routine maintenance is essential to minimise rolling stock downtime**

JUSTIFYING INVESTMENT IN NEW SYSTEMS

Technological advances mean the range of onboard services train operators offer passengers is constantly expanding. Developments such as onboard WiFi help to increase the attractiveness of rail over other modes, but inevitably this comes at a price. In an era of scarce finance, any investment has to be carefully justified and the introduction of new technologies must be supported by a robust business case covering implementation, operation, and maintenance.

Perversely, the case for new onboard systems may be stronger for operators with seats to fill than for those with high load factors. "Where you have the capacity available to increase the number of passengers you carry, the case for implementing new onboard systems is generally good," explains Chris Baker, commercial manager for Interfleet Technology. "The train is a mobile office for many passengers, and for people who charge by the hour, work on the train can often cover the cost of their fare, and that's a major advantage over driving."

This view is supported by train operators' own research. A survey of businesses for Swedish national operator SJ found the train journey is widely considered as an integral part of the working day. This suggests rail services are more likely to appeal to business travellers if they offer high-quality onboard communications.

Wi-Fi is a prominent technology that is being introduced by many train operators to support the business market and increasingly to cater for the demands of leisure travellers. "Wi-Fi generally makes a strong business case because it is a differentiator," Baker explains. "It can be used to help to encourage passengers from standard to first class, or attract passengers from other modes because it allows them to use their travel time more productively."

Seat-back television is now almost universal on long-haul flights and the technology is beginning to find favour with some rail operators. "Operators are often quite naive when it comes to the cost of these systems," says Baker. "Advertising revenues might be seen as a means of covering the investment cost, but studies we've done with advertising agencies suggest passengers don't want to see intrusive advertising on trains. Pay to view solutions are becoming more commercially attractive as the hardware and other implementation costs are reduce. Operators do need to consider the amount of on train hardware involved and the considerable cost of buying and

managing quality video content. The take up by passengers to video entertainment is also unknown, making business case approval challenging."

An alternative option is to deliver content to passengers' portable devices. "An onboard server might support video and even passenger downloads, but there is the issue of rights management on an open network," says Baker. "Often the user will need a particular type of software on their device to run these files."

THE CHALLENGES OF RETROFITTING

The retrofitting of modern passenger information systems (PIS) to older rolling stock often makes a less compelling business case, primarily because it does not directly generate revenue. This means that from an economic point of view, the principal drivers of PIS deployment are often regulatory developments such as the European Technical Specification for Interoperability for Persons With Reduced Mobility (PRM TSI). But because passengers consider it a priority, the provision of clear, accurate and up-to-date service information is vital for high levels of customer service. Operators should therefore ignore it at their peril.

Advances in communications technology are allowing operators to harmonise information provision. "Information on the platform tends to be different to what is available on the train, and there is a drive in the industry to standardize the

Investment in onboard communications will undoubtedly bring rich rewards for the rail industry and allow it to strengthen its competitive position against other modes.

< ECONOMIC VIEW >

two to create 'the one truth,'" says Baker. "Onboard information is often determined by legislative requirements, but technological advances mean there are big opportunities to join up the information we already have available and present it to everyone in real time."

Having calculated the revenue potential of a new system, it is vital to consider the technical obstacles. "Railways have very specific technical needs that are often quite different to those of other industries, and this can mean that there are a lot of potential pitfalls for new entrants," says Stephen Radford, principal consultant for Interfleet Technology. "Sometimes suppliers who are new to the railway industry take the view that if it can be done in an office it can be done on a train, but the reality is quite different. On the railway you have to contend with electromagnetic compatibility, fire and smoke compliance, power supply surge/transient, dust, and vibration. There are a lot of challenging issues in onboard technology and we often see the same mistakes being repeated by suppliers unfamiliar with rolling stock."

Where rolling stock utilisation is high, the operator will need to consider the scheduling of both installation and maintenance of new systems. "Often there is pressure to minimise the length of time a train is out of service so finding the time to fit the equipment may be a challenge," says Radford. "It can also take weeks to get a train in the right location for system and software updates."

Equipping modern trains is more straightforward, primarily because manufacturers design rolling stock to accommodate advanced passenger communication and information systems. "Rolling stock manufacturers tend to offer a standard platform using proven technology because this is what the market demands," says Baker. "Many of them are now working with the TCP/IP internet protocol suite, which means they can go to any systems supplier without worrying about how to wire the train up. Modern trains are generally built with a modern IP network."

However, the design of modern trains can sometimes create challenges for communications technology. For example, some inter-city trains used in the UK by have a metallised film layer on the windows to reflect sunlight and minimise the air-conditioning load. This makes the train more efficient but can also adversely affect mobile phone coverage.

WHO SHOULD PAY FOR THE EQUIPMENT?

One possible solution is the installation of onboard repeaters (sometimes known as cell enhancers) which use a roof-mounted antennae. "This raises several questions," explains Baker. "Do you boost the signal of one mobile network or all networks? Who pays for the equipment, the train operator or the mobile network operator? Installing repeaters is an additional cost for the train operator that in many cases would not directly generate any additional revenue. A roof-mounted antenna will only solve the problem if there are masts near the line. Mobile phone masts tend to follow the road network and not railways, which means the signal quality is often variable on railways outside urban areas."

The installation of a neutral-hosted repeater on the train may be considered as a potential solution to these issues, but careful planning will be required to avoid potential conflicts with the numerous factions involved. "Mobile operators often buy neutral repeater capacity to boost coverage in locations such as shopping malls," says Baker. "However this would be horrendously difficult to operate on a train because there are so many parties involved that it becomes a very political and fragmented process."

Another significant question for operators is whether high-capacity passenger communications should be based on on-train or off-train networks. "Will we split services between onboard servers and communications from off the train?" asks Radford. "Installing a Femtocell miniature base station on the train will allow you to do both. At the moment Femtocells only support about four users, but they are growing in capability. Assuming we can get the broadband connectivity, there could be a mini mobile network on each vehicle. A good-quality data network such as WiMax could also be used to create a cell within a train."

A recent study by Britain's Rail Safety and Standards Board (RSSB) entitled Assessing bandwidth demand for future communications needs on GB railways concluded that the rail industry faces a considerable challenge if it is to keep pace with increasing customer demand for telecommunications. It argues that the industry needs to achieve a better understanding of the degree to which poor passenger connectivity could impact the use of the rail network and how passengers' views of onboard connectivity are evolving.

Investment in onboard communications will undoubtedly bring rich rewards for the rail industry and allow it to strengthen its competitive position against other modes. But operators need to take a pragmatic approach to the issue if they are to keep pace with technological developments in this sector and meet the evolving needs of their passengers.

< CUSTOMER VIEW >

INTEGRATED INTERNATIONAL TRAVEL – THE CHALLENGE AHEAD

BY: MARK SMITH, THE MAN IN SEAT 61

HIGHLIGHTS

- **Ticketing is a key element of the international travel experience, but the process remains fractured and focussed on domestic users**

- **Liberalisation may have exacerbated complications of international travel by pitting operators against each other when cooperation is needed**

- **Advanced passenger information systems (PIS) technology is only useful to travellers if operators ensure high-quality real-time information is provided**

A TICKET TO RIDE (TO THE BORDER)

The advent of budget airlines in the 1990s was a disaster for international rail travel in Europe. Suddenly it was possible to book a single ticket and travel almost anywhere quickly and cheaply. But the love affair with cheap flights brought with it congestion in the skies and at airports, and the steady tightening of security together with increasing environmental awareness and the development of the high-speed rail network means the balance has begun to shift once more in rail's favour.

With fast, clean, and comfortable modern high-speed trains linking many of Europe's major centres, rail is now a highly-attractive alternative on many routes. But while the air passenger generally has one ticket and one airline, the international rail traveller often faces the bewildering complexities and inconsistencies of interfacing with several different operators before and during their journey.

Many train trips begin on the internet and there are few better places to start than The Man in Seat 61 (www.seat61.com). The website is run by Mark Smith a career railwayman who worked for British Rail before joining the Department for Transport managing the team that regulates fares and ticketing. Smith has travelled the world by train and combined with his industry experience this gives him a unique insight into the intricacies of planning an international train journey.

Ticketing is a key element of the passenger experience and for international rail travellers it can often pose challenges. "Each operator has their own website, so planning multi-leg journey often becomes a nightmare," he explains. "For example if you book Amsterdam – Zürich on the DB website it shows the full international fare, but if you break the same journey across national websites you can get national discounts. The French system can't mix and match fare types and prices. Outside Britain, France and Belgium, the Eurostar website only allows you to book to a very limited range of destinations."

Furthermore, different websites often produce different results. "London – Amsterdam is one of the busiest air routes in Europe, but the journey time by rail is competitive so it should be easy to take the train," says Smith. "Often the Eurostar website shows fares of over £200 when a £69 return to Brussels is often available on the same train, and you can book a separate ticket for the Brussels – Amsterdam leg for as little as £21."

COMPETITION VERSUS COOPERATION

Smith believes that contrary to the goals of policymakers, the gradual liberalisation of Europe's railways has exacerbated the complications of international rail travel by pitting operators against each other. "There has been a push for competition by the EU, so operators are weary of working together when in reality this is the one thing international passengers really need them to do," he says.

Another issue is the booking horizon, which is sometimes squeezed down to less than 30 days. "You have a ludicrous situation where the EU mandates that timetable changes must be implemented two weeks before the Christmas break," says Smith. "This means passengers who want to go by train are forced to fly, while railways are throwing away millions of Euros."

Smith argues operators must find ways of working together to simplify international travel in order to unlock the network benefits of rail and drive a modal shift from air transport. "Operators need to understand the value of interconnecting journeys," he says. "They need to give each other connectivity to each other's distribution systems and make information more readily available for international passengers. There's no reason why we can't have international systems linking local systems."

ONBOARD COMMUNICATION SERVICES – THE DIFFERENTIATOR BETWEEN RAIL AND AIR

The rapid increase in devices such as laptops and smartphones in circulation highlight the advantage of rail over air, and the ability to use these devices on the train

is an increasingly-important differentiator between the two modes. " Railways are discovering that productivity is an issue for travellers, and rail has an advantage in this area because they can spend travel time productively," he says. "Five hours uninterrupted working on a train is better than an hour on a flight with perhaps a few minutes on the laptop waiting at the airport. For business travellers, and increasingly leisure travellers, the ability to use devices onboard is an increasingly-big attraction of rail, particularly now some operators are using these devices to provide real-time journey information."

However, Smith warns technology is only useful to passengers if operators ensure high-quality information provision, particularly on international journeys. "Real time information is often patchy and fragmented," he says. "If you are travelling in Germany, for instance, you can go to the DB website before you set off and the information is up-to-date and good quality, but if you are travelling across several countries with multiple operators, things become more difficult. For instance, I recently travelled from London to Istanbul.

The only way you can get information about the whole trip is to visit the website of each railway, in this case that's six or seven different sites. Many of them are not regularly updated – there was a bridge replacement in Turkey which meant a bus replacement was running on part of the route, but this wasn't mentioned anywhere."

While technological advances offer new possibilities for passengers in terms of ticketing, access to stations, and onboard connectivity, Smith stresses the importance of careful implementation and thoughtful

tickets generally cater for domestic users," he says. "There is a danger that technology might make it harder for passengers to use public transport flexibly and operators need to be mindful of this when implementing new systems."

With this in mind, finding common ground in public policy and business practices is essential if operators from different countries are to succeed at introducing technologies that will benefit train travel on international routes. Only then will the potential advantages that technology can bring be realised, to the benefit of both

For business travellers, and increasingly leisure travellers, the ability to use devices onboard is an increasingly-big attraction of rail, particularly now some operators are using these devices to provide real-time journey information.

product development. "My only concern is that sometimes technology makes it harder to travel beyond borders, for instance national smartcards or mobile phone

passenger experience and ridership as more people switch from budget airlines to cross-border rail services.

<   **EXPERT VIEW**   >

PUTTING INTERACTION INTO ACTION: ALCATEL-LUCENT'S PASSENGER EXPERIENCE SOLUTIONS

BY: OLIVIER ANDRE, ALCATEL-LUCENT

HIGHLIGHTS

- **The 21st century railway passenger expects a wide-range of interactive communication services before, during and after their journey**

- **Operators consider the adoption of these technologies as an opportunity to find out more about their passengers which could open up avenues to targeted advertising**

- **The development of the smartphone is crucial for much of this technology to fulfil its potential**

Train travel is changing. With society increasingly embracing interactive technology, passengers now expect to have access to a range of communication services before, during and after their journey. An internet connection is a must, while accurate journey status and destination information are also desired to enhance passenger experience. In the 21st century a good view out of the window is no longer enough for rail passengers.

Rather than becoming bogged down by these new demands, operators sense an opportunity. As well as helping them to provide more efficient and improved service, technology is telling them more about who their passengers are and is also opening up avenues for targeted advertising. However, there needs to be a balance between the two.

An operator's primary goal will also be to serve their passengers' needs; there is no point in employing technology for the sake of it. At the same time there is a business need to control costs because you need to make a profit out of the operation. Combining the two is therefore crucial in order to offer the appropriate services that will attract new passengers and keep those that you already have.

INNOVATIONS FOR ANYWHERE PERSONALIZED INFORMATION

Different operators inevitably require different forms of interactive services depending on the type of passenger they carry and the types of journey they offer. While many of these services have been around for a few years now, the manner in which information is presented and the level to which passengers can interact continues to advance. The smartphone is,

personally about their journey status with the potential to offer alternative routes if they are delayed or even a ticket for an another train.

Locating the platform is one of the most stressful parts of a train journey. But again smartphones have the capability of alleviating these concerns by guiding passengers through unfamiliar environments while also pointing out noteworthy locations on the way. Augmented Reality provides a geographic guide of a station and instructions on how to reach the correct platform. Various service locations are highlighted along the route with the potential for some of these companies to offer passengers discounts if they show their phone when making a purchase. There is also the capacity to link to social network applications. So if any of your friends are in the station, the GPS on their phone can tell you exactly

Onboard communication technology has advanced significantly to the extent that the train is able to act as an extension of the office or as an entertainment centre.

however, perhaps the key innovation that has enabled many of these services to fulfil their potential.

For the first time operators are able to engage with their customer from the moment they buy their ticket online or through their mobile phone to the conclusion of their journey by voice, e-mail or SMS communication. As a result passengers can now be informed immediately and

where they are so you can keep track of them and decide whether you want to go and talk to them or not.

When passengers do make it to the platform, interactive rather than traditional LED panel screens can provide detailed updates on journey status as well as entertainment and destination information. This can have the effect of reducing perceived waiting time by distracting passengers

while making the station a more pleasant environment. For example digital signage technology in Beijing for the 2008 Olympics and for the 2010 Shanghai Expo displayed regularly updated information on the daily schedule as well as local weather information.

EXTENSION OF THE OFFICE

Of course supplying passengers with updated information does not have to stop on the platform. Onboard communication technology has advanced significantly to the extent that the train is able to act as an extension of the office or as an entertainment centre.

Naturally before passengers can use these services they have to locate a seat. This process can be aided through an intelligent seat reservation system that informs passengers without reservations through their smartphone where exactly on the train vacant seats are located. Using RFID, a proximity system, individual passenger locations are identified and the reservation system is updated in real-time if they have not sat in their allocated seat. Open seats that have a reservation, but no one sitting in them can also be opened to other passengers.

Access to a WiFi connection is already considered an essential service for many passengers, and is becoming increasingly common. At the moment this service is supplied through a mobile operator and there are often capacity problems so if you do something complicated the connection often drops. However, with future broadband and radio technologies such as LTE being developed to offer a reliable, consistent, and strong performing WiFi connections, passengers will soon be able to access large volumes of data without losing their signal.

As well as WiFi connections, LTE will also improve onboard passenger entertainment systems that are beginning to appear on trains such as video on demand services and interactive maps like those used on aeroplanes. It could also potentially facilitate a live connection to the outside world including providing live television reception.

Individual and communal screens will similarly be capable of showing information about specific destinations such as weather updates and ongoing connections as well as the capacity to book a hotel room or a table at a restaurant in that city. Passenger security concerns onboard a train can also be addressed through applying technology. It is now possible to transmit a live CCTV feed from cameras strategically located on the train to a central location, a service that Alcatel-Lucent has already delivered to RATP in Paris.

Smartphones can again be an important tool for passengers when they arrive at their destination. Technologies such as Alcatel-Lucent's Geo Location feature displays on a passenger's phone exactly where they are at the station and can highlight the path to the platform, bus stop or taxi rank that they need in order to continue their journey.

TRUE BOND

The abundance of information made available about a specific passenger's travel habits throughout a single journey and across a period of time means that a railway operator can for the first time develop a true bond with their customers. This is inevitably a powerful tool for tailoring services to better meet passengers' needs and also to generate revenue through specialised advertising campaigns which have the potential to be a huge boon to railways.

Choosing the right provider to deliver the most appropriate interactive services is an increasingly important consideration over the next few years as more and more of these technologies that are intended to improve passenger experience are rolled out. However, manufacturers need to take into account that railways require very specific equipment that is tailored to their operations. In such a specialised market we are well placed to deliver the innovations that best suits a specific operator, and most importantly, that passengers want.

SUBSCRIBE: www.alcatel-lucent.com/blogs/tracktalk/

CONTACT: olivier.andre@alcatel-lucent.com

VISIT: www.alcatel-lucent.com/railways

Alcatel·Lucent Ⓐ