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*Ingenuity for life*

## Increasing COVID-19 resilience of public transport

Offerings to mitigate risks for passengers  
and operators

July 2020

[siemens.com/covid-19-offerings](https://www.siemens.com/covid-19-offerings)



Siemens Mobility has been a leader in transport solutions for more than 160 years and now employs around 36,800 people worldwide. The organization is constantly innovating its portfolio in its core areas of rolling stock, rail automation and electrification, turnkey systems, intelligent traffic systems as well as related services.

With digitalization, it enables mobility operators worldwide to make infrastructure intelligent, increase value sustainably over the entire lifecycle, enhance passenger experience and guarantee availability.

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## Restoring safety and confidence in public transport

Ready-to-go solutions for public transport operators, authorities and traffic management operators

### Foreword

There is little doubt that we have all been heavily impacted by the global COVID-19 pandemic. The past few months have been unlike anything that most of us have experienced in our lifetime. Our normal routines have been disrupted, travel plans have been postponed and our work patterns have changed.

Home working, and the associated technological challenges it can bring, has become the norm for many of us and we've become expert at talking to loved ones, friends and work colleagues through our computers and smart devices.

We have become used to being less mobile, reducing time spent commuting (if travelling to a workplace at all) – and even to shopping less frequently. Home schooling has, for many, been a special challenge.

In many countries COVID-19 policies and rules are now starting to relax again.

These actions bring additional concerns and challenges. As we move to the 'new normal' and the next phase of containing and curtailing the spread of COVID-19, it is time for us to build on this new, connected, world.

As restrictions are eased, people need to feel safe to travel by public transport again. This involves using solutions to boost confidence in using public transport. We know that moving people and goods from place to place has positive economic impact. The ability to do this safely will encourage economic recovery.

### Intelligent infrastructure is critical

Mobility is essential for society and economy. It connects people to jobs, social networks, education and leisure activities. This is always the case, but it is essential in the COVID-19 pandemic to keep society healthy and running. We believe seamless, safe, reliable and sustainable mobility is only achievable with public transportation and rail at its core. We can ensure that for the entire mobility ecosystem – from the first to the last mile.

We have a clear part to play in ensuring that people are confident and feel safe to travel by public transport. This includes a significant role to help counter any potential capacity challenges resulting from the implementation of safe social distancing. We must also ensure our roads don't become more congested as people choose to travel by private vehicles. A gridlocked transport network is neither safe nor desirable.

Our expert engineers and product designers have identified physical and technological solutions that will make industry employees and passengers safer, helping them take decisions about their daily travel and work.

We have approached the challenge through the experience of the passenger and the employee, using technology to provide holistic, whole-journey solutions – from pre-trip planning, to entering a station, being on-board of public transport and to looking at post-trip solutions, including individual modes of transport.

It is time for us all to consider the way forward, finding the right solutions post COVID-19. We hope that together we can plan the next steps in our journey towards a new normal.



Michael Peter,  
CEO Siemens Mobility

**"Mobility is essential for society and economy. It connects people to jobs, social networks, education and leisure activities. This is always the case, but it is essential in the COVID-19 pandemic to keep society healthy and running. We believe seamless, safe, reliable and sustainable mobility is only achievable with public transportation and rail at its core. We can ensure that for the entire mobility ecosystem – from the first to the last mile"**

# Global COVID-19 transport trends

The COVID-19 crisis has created a severe shock for public transport. In general, ridership figures globally have dropped significantly due to various lockdown situations, the need to maintain social distancing and calls to avoid the use of public transport where possible.

Naturally, this has led to financial difficulties and operating losses within transport operating groups, often with government support required to secure public transport as key critical infrastructure within countries, both now and for the future.

But things are changing.

The free movement of goods, people and services – from the first mile to the last – is essential for sustained economic recovery and development. In addition, the current crisis cannot change the fundamental human need for physical interaction.

Where countries are relaxing restrictions, we have seen positive signs of a bounce back of demand. This gives indications of a resilient long-term market and prosperous outlook with confidence that passenger demand will rise, in most areas, to pre-COVID levels by the second half of 2021.

However, it is also clear that there are regional differences.

- In the **USA** road transport plays a stronger role with relatively weak sustainability regulations. We see strong recovery of ridership within established mass transit systems, but road-based mobility might be dominant in other urban areas.
- **Latin America** is experiencing severe economic difficulties which may lead to the postponement of infrastructure investment.
- There is still a stable outlook for **Europe** at a high level, with the decarbonization agenda driving the expansion of sustainable public transport and stimulus programs.

- **China** is starting to recover; although there has been some project postponement, significant investment in physical and digital transport solutions is expected.
- In the rest of **Asia**, public transport plays a major role in most cities and will stay high on government agendas, however potential budget restrictions may lead to deferred investment plans.

One common theme is the need to rebuild and reinforce passenger confidence. Siemens Mobility's research in the UK, for example, shows 86% of the public associate the railway with a heightened risk of exposure to, and transmission of, the virus, rising to 95% of those who exclusively use the railway to commute in normal times. The polling also indicates a potential reliance on the car to make journeys as people adjust their routine.

In the following pages we will explore some of the options to restore confidence and increase resilience for moving beyond.







# Offerings to increase COVID-19 resilience

Passengers and operator staff members are making their way to the new normal - many innovative products and solutions can support them along their intermodal journeys



Dave's passenger journey



Emma's operator journey

## Associated high-risk situations that these solutions address:



*Social distancing is compromised with unmanageable volumes of passengers*



*Increased likelihood of airborne transmission*



*Increased exposure of vulnerable groups and key workers.*



*Increased risk of surface transmission with contact payments*

## Associated opportunities that our mobility solutions offer:



*Full transparency and direction of passenger flows*




*Automated/contactless operations*



*Remote support*



*Intermodal mobility management*

A woman with long brown hair, wearing a brown plaid blazer, blue jeans, and brown shoes, is walking away from the camera on a train platform. She has a brown shoulder bag. To her left is a high-speed train with a white and grey livery. The platform has a curved edge and a tiled floor. The background shows the train tracks and some overhead lighting.

It is time for us all to overcome the current COVID-19 restrictions and consider the way forward.



# Passenger journey

01



## Pre-trip offerings

To increase capacity and demand, government and those working in the transport industry will need to demonstrate to the public and passengers that life in the new normal is safe across all modes of transportation.

An excellent passenger experience starts with the ability to have a fully transparent journey at the traveler's fingertips – this includes planning of all modes of transport, contactless ticketing and, above all, safety information. As they begin to return to public transport, people will want to pre-plan their trips, helping them avoid concerns about traveling before they set off. This will also help when using new modes of transportation that previously they've not been accustomed to, such as Demand-Responsive Transport.

02



## On-trip offerings

In addition, passengers want to see that the new normal experience of bus and railway stations has changed. This means they need up-to-date, real time information that helps them confidently take risk-mitigating decisions about their travel.

For passengers to experience public transport as safe and reliable, vehicles can be equipped with a variety of measures from no-touch boarding and exiting and specific filter systems, as well as giving all available information on the COVID-19 risk status.

03



## Post-trip offerings

Passengers may consider their trip on a train or bus to be the point at which they are at highest risk, however their journey doesn't usually end there. As a result, credible actions need to be taken by the authorities to restore confidence in public transport.

For passengers, capacity information and various digital solutions help them to move seamlessly and safe at the station and on their way to the final destination. This means the relationship between operators and passenger does not stop at station exit. Operators will have more contact with their customers post-trip, through intelligent traveler relationship management.











## Making a smart and safe decision when travelling in public

### COVID-19 minimum trip planning

While most people have been very conscious about avoiding risks from COVID-19 in recent months, it is hard for travelers to predict how other passengers will behave and when they will encounter congestion when they use public transport.

Adjusting and planning routes is a good way to support social distancing. To effectively minimize the risk of overcrowding, new rules must be implemented. Longer transfer times and routing with apps from HaCon, a Siemens company, that avoids highly frequented lines can help create space between travelers. This also allows people with health considerations to make safer choices.

The application COVID-19 minimum routing will support passengers in making smart and safe decisions about their end-to-end journey and to be better informed.

It allows them to keep out of congested areas and make decisions using dynamic information about train carriage occupancy and predefined rules to plan their journey safely and minimize exposure to infection.

The system is able to predict occupancy levels for lines, stations and single services seven days or more in advance. Passengers can access the information via apps and monitors to find the routes with lowest occupancy.







## Transportation at your fingertips

### Mobility as a Service platform

With a smaller number of passengers traveling, public transport might operate less frequently. Mobility as a Service (MaaS) with Mobility Marketplace from HaCon allows authorities and operators to offer flexible mobility options, to increase their confidence in safe transportation and to secure long-term passenger loyalty.

For traditional operators, the step towards MaaS is their ability to integrate new first and last mile choices to their trip offers. There are many sharing options available in cities, from shared bicycles, scooters and cars, to Demand-Responsive-Transport (DRT) modes operated through mini-bus services.

Enabling MaaS and integrating, for example, shared modes and DRT in the booking options, requires access to the passenger via either an existing app or a new one to provide a digital touchpoint.

### Case study

Establishing Mobility as a Service – this is what HaCon, a Siemens company, and Rejseplanen have been working on together. Based on HaCon's Mobility Marketplace, a wide variety of data and interfaces have been integrated into one comprehensive trip planner – from public and private transport to DRT, road traffic information, car and bike sharing providers, taxis, carpooling services and domestic flights with real-time data. Due to smart features, for example in-app ticket booking and push notifications, Denmark's trip planner Rejseplanen is one of the most popular apps in the country with over 3.7 million downloads.



## Reduce contact with potentially contaminated surfaces

### Contactless ticketing

While ticketing machines, service desks and queues can pose a risk for infections to travelers, online ticketing solutions, including the use of mobile devices, offers an efficient and safe alternative for operators.

Next generation, contactless ticketing via smartphone with full flexibility of checking or being in/out not only limits these interactions for passengers but also makes buying a ticket easier, as they do not need to understand the tariff and pricing system. The system performs automatic check-ins or check-outs for the passengers and calculates the best tariff for the trip, making the booking and ticketing process easy. Digital ticketing data can additionally be used to calculate occupancy levels for specific lines and even individual services.





## Transportation when needed

### Demand-Responsive Transport application

While mass transit solutions can transport large numbers of passengers to their destination, passenger demand may vary and be less easy to predict as a result of COVID-19.

In this situation Demand-Responsive Transport (DRT) solutions can be useful. Padam Mobility's (a Siemens partner) DRT software provides first and last mile transport services and can be aligned with scheduled rail and bus services, allowing passengers to book bus services using an app or web-based service.

The app allows implementing social distancing measures through vehicle capacity management and can be used to provide key workers and vulnerable passengers with alternative transport options away from mainstream public transport. This includes door-to-door travel and extended service schedules. The system makes use of fixed routes and new 'virtual routes' that adapt to user requests. Pre-booking travel allows the number of users to be managed and prevents overcrowding, while keeping capacity at optimum levels.

### Case study

In Strasbourg, in the Grand Est region in France, the Compagnie des Transports Strasbourgeois (CTS), in collaboration with Padam Mobility, adapted its Flex'hop service to the needs of hospital staff by extending services time slots and serving essential locations. Responding to social distancing measures, booking through the Padam Mobility app takes into account the capacity of vehicles and limits the number of reservations available in the system.







## Contactless door solutions for entry and exit

### Automated door opening for entry and exit

The exit button is a surface frequently used by passengers. This creates a risk of virus transmission. Additionally, this is frequently an area which is responsible for delays during stops.

The automation of door opening allows passengers to exit trains without having to push the button on train doors. This is done by contactless motion detection which is, for example, already in use in Siemens Mobility's ICE trains in Germany. In existing trains, motion sensors can be retrofitted and for new trains this option can be specified at the outset.

The solution not only helps passengers to avoid touching objects and therefore reduces the transmission of COVID-19, but also speeds dwell times at stations.





## Avoiding frequently touched surfaces

### 3D-printed solutions for frequently touched devices

While travelling on trains there are areas shared by all passengers. These increase the risk of surface transmission. Additionally, to meet social distancing requirements not all seats can be occupied. To counter both issues with Easy Spares Next Generation, Siemens Mobility offers custom-made 3D-printed parts as part of its focus on additive manufacturing. They are polymer-constructed making them easy to clean, install or remove. The 3D polymer can be recycled reducing the overall carbon footprint of the lifetime of the solution.

### Temporary seat blocker

Temporary seat blockers can be installed to uphold social distancing measures within the confines of the carriage. A 3D-wedge, suitable for all seats, can be fixed to seats to manage social distancing requirements and will provide a visual reminder that preventative measures are in place to reduce the possibility of virus transmission. The wedge can be rapidly installed and/or removed as social distancing measures change and can be reapplied in the future to block off unusable seats under normal operating conditions.

### Adapted bin lids

An alternative bin lid offers passengers 'no touch' waste disposal, minimizing touch points in trains and reducing the transmission of COVID-19. By adding a 3D-printed bin lid attachment, passengers can dispose of their waste in on-train bins without touching the surface of the bin. There is no increased litter left on the trains as passengers can safely use the bins.

### Toilet foot flush

A foot-operated mechanism enables passengers to flush on-train toilets without hand-to-surface touching. The printed part can be installed without complex modification. The mechanism is secured to the floor adjacent to the toilet bowl, providing a spring-loaded foot button. When the user operates the foot flush, the mechanism 'presses' the toilet flush button for the user.

### Door handle

Special attachments enable doors to be opened with an elbow or lower arm rather than a hand reducing the risk of spreading germs or a virus like COVID-19. The parts are produced with the help of additive manufacturing and can be delivered on demand. This can be easily changed in the future.

### Case study

Russian Railways is currently testing 36 attachments for door handles. Siemens Mobility recently purchased two Stratasys 3D printers to support the maintenance of the Russian train fleet. This door opener prototypes were installed in several Desiro trains being operated in the Moscow area. Implementation in further train fleets in other countries is planned.







## Air sanitation within rail carriages

### Heating, Ventilation and Air Conditioning (HVAC) optimization with anti-COVID-19 technology

To ensure a good travel experience, the Heating, Ventilation and Air Conditioning (HVAC) system creates a comfortable temperature for passengers. The system is pressure-protected and there is fresh air in the train. This system regulates the control and exchange of air inside and outside, with filter systems used to minimize pollutants, for example, dust. However, circulating air can also circulate germs and viruses and pose a potential risk for passengers.

Siemens Mobility offers various options to reduce the risk of spreading bacteria and viruses. Increasing the fresh air volume flow rates within existing HVAC systems allows the highest possible fresh air volume flow resulting in increased air exchange. It is also possible to equip HVAC systems with high-efficiency particulate air filtration systems which filter out bacteria and viruses. The same can be achieved with the installation of additional air disinfection units with high-efficiency particulate air filtration systems. In the UK a trial is planned with fan and filter units which are designed to circulate and clean the air in a defined area to remove COVID-19 and other compounds.

While the COVID-19 pandemic has spread exceptionally fast, there is still limited information about the virus. This also holds true for its impact on the train industry. Siemens Mobility runs Computational Fluid Dynamic (CFD) simulations to show the spread of micro-droplets in trains.



## Travelling with information

### On-board information and communication system

During peak times, but also in exceptional situations, a large number of people want to exit a train at the same time. Without proper guidance it might be difficult to meet social distancing requirements. An intelligent passenger information system in trains not only provides travelers with orientation but gives appropriate guidance for the situation.

The Passenger Information System Plus (PIS+) flexibly provides information in real-time on train delays, malfunctions and incidents. The system can easily be modified to include specific COVID-19 regulations. Depending on the passenger's location it can also provide related information for trains, stations, city or states. Displays show door-specific information for each station and COVID-19-safe directions to ensure social distancing.





## All information at your fingertips

### Passenger information application

The COVID-19 pandemic has increased travelers' uncertainty. Passengers want full transparency and all information they need to know to judge their safety risk.

The passenger information app can provide all information on the current safety situation directly to the passengers' mobile phones and explains measures taken to help ensure a safe commute. This reinforces loyalty and trust. A wide range of functionalities are possible from static tutorials and dynamic customizable web-view news, to allowing passengers to give feedback on occupancy levels or their general well-being while traveling.

All messages in this mobile app are fully customizable and are aimed at better informing passengers as well as increasing the operators' and authorities' flexibility to adapt to changing conditions. The app strengthens the operator's relationship with customers and their openness to share additional valuable information.



## Improve throughput and increase safety

### Capacity solution

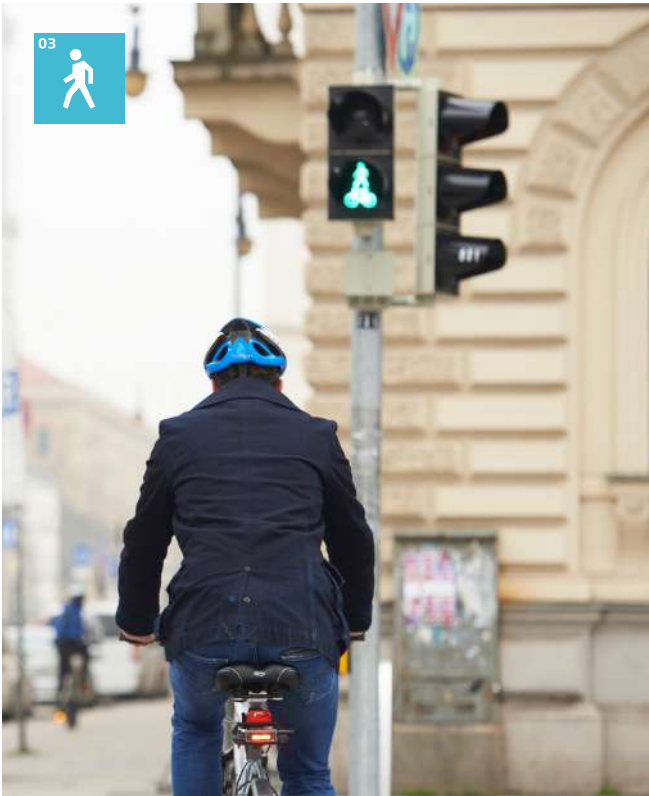
Railway stations, where train lines come together and people wait for their next train, have the potential to contain a significant amount of people in a confined space. As a result, operators need to ensure they keep people informed of measures taken to keep them safe and direct crowds efficiently.

Siemens Mobility's Capacity solution provides a comprehensive overview of the station environment. Not only does it show the current occupancy of the station and specific areas like the platforms, but in combination with external data like the weather or specific events, it can forecast passenger volumes. It also shows how many, where and when people are complying to social distancing guidelines.

Additionally, the solution brings transparency to passenger flow, aiming to guide people through the station to avoid contact with other passengers. It also measures, calculates and analyzes the dwell time of passengers to assess network efficiency and required scheduling changes. This all has a significant impact on the availability of relevant services, passenger throughput and the overall passenger experience.







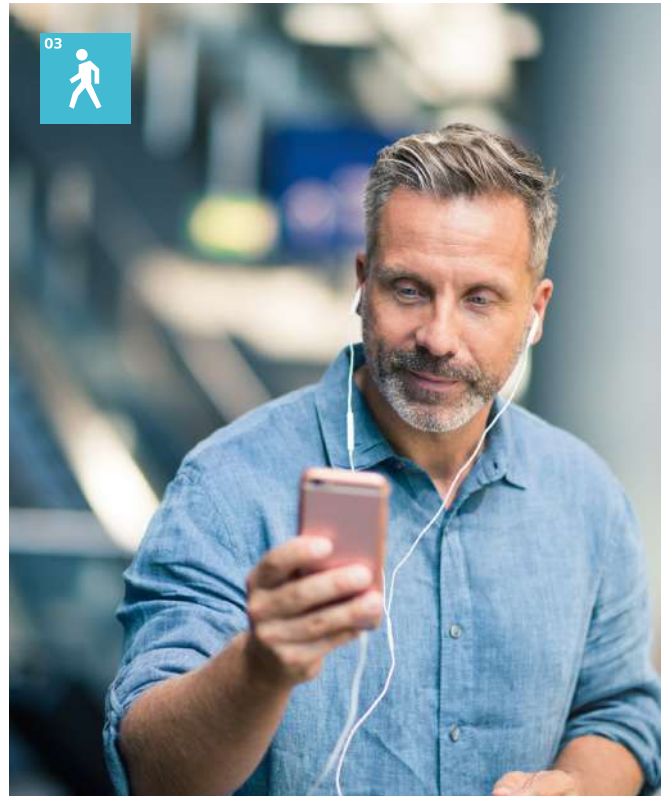
## Green wave for cyclists

### Traffic solutions for bikes

In many major cities, cycling has become a major form of transport during the COVID-19 pandemic. It is therefore important for traffic operators to ensure a provide proper traffic flow and optimum performance of their road network. As the trend shifts back to individual traffic options, cycling is the best way to save reduce emissions and keep the CO<sub>2</sub> levels down. With our holistic approach with Sitraffic SiBike and Operide, we support cities and transport authorities to increase safety and comfort for cyclists. With green wave solutions, advanced detection and counting, shared fleet management software and gamification apps, more people can be motivated to use bikes more often and operators gain critical information about routes and traffic.

### Case Study:

In Munich the first tests conducted with SiBike have shown that the app reduces the number of times cyclists stop, shortening their average travel time without having a significant impact on public transport.



## Retaining trust

### Traveler relationship management

To regain passenger confidence and trust in public transport, traveler relationship management is key in the current pandemic situation. This helps operators to relate to their passengers even after their trip, helping understand if they have met their needs and for increased contact and loyalty.

Traveler relationship management helps operators to relate to their passengers even after their trip, helping understand if they have met their needs and for increased contact and loyalty.

Operators can use existing passenger information apps and enhance them with additional traveler relationship management features.

These, for example, include a "safe trip" rating function to understand passenger's satisfaction with the implemented safety measures. This could also include loyalty programs to reward the traveler for their valuable feedback and for continuing to use the services.



# Operator journey

01



## Design and planning

Data and the corresponding analytics provide a solid base for transport authorities and operators to reshape mobility services and offer seamless, safe and sustainable solutions, from the first mile to the last. Their tasks range from the simulation and optimization of public transport on the basis of behavior and occupancy data, to the planning of road traffic to enable intermodal mobility management.

02



## Development and operations

During the development and operation phase, authorities and operators can build upon a variety of innovative solutions. Remote project execution and Automatic Train Operation provide the opportunities to increase the resilience of services and internal processes while protecting staff from COVID-19 incidents. Filters or surface coatings for staff related areas ensures personnel safety.

However, the optimization opportunities don't stop at the system boundaries of public transportation. Given the trends towards intermodal mobility operators, digitalization enables an overall orchestration of rail and road transport as well as an intelligent demand management.

03



## Lifecycle services

For operators and asset owners, the lifecycle phase is both an opportunity to disinfect the trains and also provides the chance to make the most of digital solutions with the help of remote services or predictive maintenance.

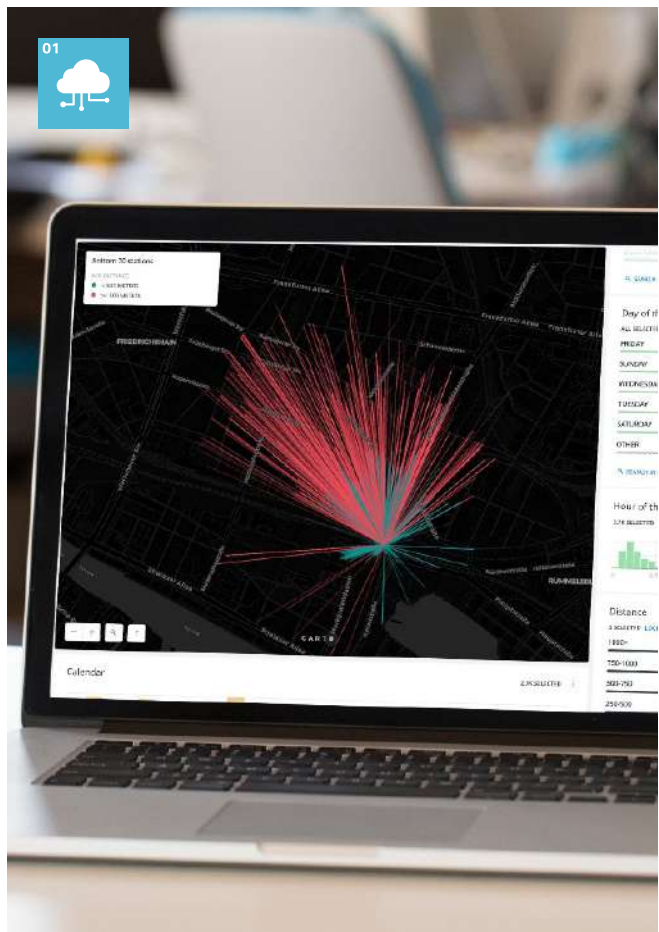
In addition to operational lifecycle service improvements, the current financial strains can be managed with new financial and service offerings based on sale and lease-back models.







*The free movement of goods, people and services - from the first mile to the last - is essential for sustained economic recovery and development. In addition, the current crisis cannot change the fundamental human need for physical interaction.*



### Optimizing mobility services day by day

#### AI-driven mobility analytics

Passenger travel is now less predictable. Operators need to not only know what is happening in their system, but also to benefit from forecasts and to base their decisions on real-time data.

AI-driven mobility analytics provide deep insights on the impact of COVID-19 on passenger behavior, e.g. by analyzing trip requests, station occupancy or the number of transfers. Therefore, mobility operators can truly optimize their services based on specific needs and requirements. Mobility Analytics is based on the HAFAS system of HaCon, a Siemens company – the leading software specialist in Europe for planning, scheduling and information systems.







## Finding the best post-COVID-19 mobility plan

### Simulation and prediction software

During the pandemic finding a new way of operating was very much in focus, however it is also necessary to prepare post-COVID-19 plans. Innovative software enables cities to simulate and study the impact of different schemes or operational plans to adapt their post-COVID-19 mobility plans.

Aimsun (a Siemens Mobility business) software has dedicated simulators to model pop-up bike lanes, social distancing on pavements, and to study modified public transport capacity/schedules and increased demand for micro-mobility options. By estimating demand and testing different scenarios, such as diminished demand or peak-demand reduction strategies, authorities and operators can optimize response plans. Over 6,000 users in more than 85 countries worldwide already use this software to fine tune their operations.



## Flexibly changing the prioritization of traffic modes

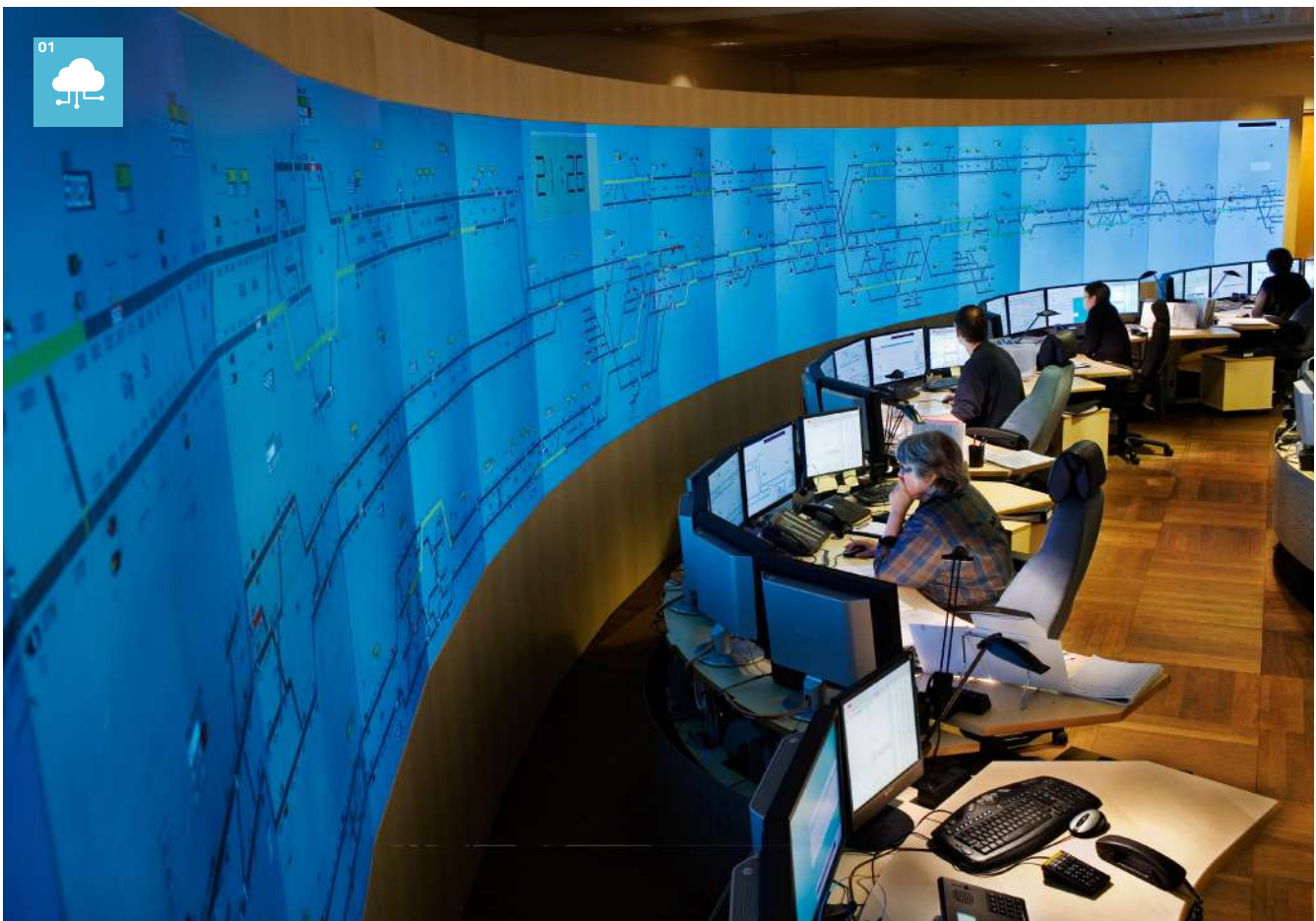
### AI-driven traffic flow optimization

During the pandemic, cycling and the use of personal transport have increased. So, cities and municipalities have to continuously adapt to changing situations, particularly using intelligent traffic management systems.

Our adaptive traffic management system is an artificial intelligence powered development that allows cities to actively manage traffic demand according to mobility policies. Using this system, operators can easily select and change the priority of different road users and desired quality parameters.

It is able to optimize the traffic flow, for example, for bikes or individual vehicles. Well-managed traffic reduces congestion and, as a result, CO<sub>2</sub> emissions.





## Avoiding the crowds

### Vehicle occupancy detection for operations

Commuters, in particular, often choose the same train carriage as is closest to the station exit. This can result in some train cars being crowded, with space available in others. With social distancing in mind there is a need to manage and limit the number of passengers able to board trains.

Siemens Mobility provides a solution for vehicle occupancy-based passenger distribution to help quickly guide passenger to safe and available seats and train cars. The vehicle occupancy detection system monitors the number of passengers on trains, supporting service operation and timetable planning to assist with safe social distancing.

Operator staff can access an online tool which gives both real-time and historical analysis for occupancy levels by unit and route. This enables the operator to understand real-time passenger loading and analyze data by route, train, location and timespan, all configurable within the tool. This solution provides detailed and valuable information to employees to empower them to manage risks.

In combination with Passenger Information System Plus (see page 15), a seamless COVID-19 info and guidance experience can be achieved to increase safety and passenger confidence on trains.

### Case study

Monitor and manage occupancy levels to determine real-time capacity and data for management of the network. This solution is already in place across Siemens Mobility's Class 700 trains for Govia Thameslink Railway.







## Delivering as promised

### Remote project execution

Siemens Mobility is proud that during the pandemic it has kept its factories open, using safe working practises to deliver projects on time as promised to customers. In addition, we have optimized traditional engineering, testing and service processes and brought them to a new, more digitized level.

When there is a need for experts to visit a customer or project site, digital tools and existing digital infrastructure are used to replace in-person appointments. In close collaboration with the existing Siemens Mobility team on site, these remote options can be used in various ways, for example, for remote factory acceptance tests and commissioning, remote testing with network systems and remote vehicle handover and approval.

As a result, Siemens Mobility can leverage its vast experiences with digital technologies, such as augmented reality solutions and BIM methodologies and tools to support remote project work.

Remote working not only turns a social distancing situation into a contactless execution and increases the efficiency and flexibility of project execution, but also provides a move to increased digitalization of documentation and training. Additionally, it increases the sustainability of project execution.





## Running trains at higher frequency

### Automatic Train Operation

While there is a need for social distancing and to reduce the number of people on mass transit systems at any one time, a higher frequency of service can be both expensive and difficult to resource with available trains and staff.

An Automatic Train Operation (ATO) with Trainguard MT provides multiple benefits. Offering trains more frequently to fulfill the transport demand reduces the number of people per car and provides a more flexible timetable, which can be adapted to the actual need and a better operational cost structure based on an optimal driving strategy. Siemens Mobility has offered this type of automation system on metros for many years and a first pilot on the automation of trams is underway in Potsdam, Germany. The Thameslink project in the UK is the world's first commercial ATO application in mainline rail services with ETCS.

Trainguard MT is the world's leading Communication-Based Train Control (CBTC) system, which can even handle trains with different train control equipment on the same network.

### Case study: Nuremberg metro

The metro line U1 is the oldest and longest of Nuremberg's three underground lines and also has the highest number of passengers.

The number of passengers, and therefore capacity requirements, has increased over recent years. Especially during major events, such as the Nuremberg Christmas Market. The metro lines U2 and U3 are already fully automated and the trains delivered for U1 have this capability.







## Reducing surface transmission

### Activated coating for driver cabins

While the number of drivers accessing a train cab in any one shift is limited, there is the potential to spread virus transmission via hard surfaces with significant cleaning effort required before changeover.

An active coating may be applied by Siemens Mobility on all hard surfaces in the driver cab providing continually sterilized surfaces and touch points and preventing droplet-based infection. It includes antibacterial and antiviral overlay for any frequently-touched surface (such as door open and close buttons, brake levers, etc). The coating is activated by non-harmful far-UVC light and is continuously available in the driver cab through fixed bulb installations. It is sprayed onto a surface and then bonds at the nano level. No additional cleaning effort is necessary. The activated coating for driver cabins is currently tested and in pilot phase.



## Orchestrating the mobility landscape

### Mobility Operating System

Even before the pandemic the change in mobility has made traffic more diverse. The current situation fuels this process even more. How can transport authorities or cities be in the driver seat and regain control on urban mobility?

The Siemens Mobility mobility operating and advanced traffic management system Sitraffic Symphony integrates a wide range of road traffic, public transport and third party subsystems, applications and services. This enables authorities and operators to predict, monitor, manage and orchestrate their complete mobility landscape, for passengers and freight as well as for all related operators and Mobility as a Service providers, so that efficiency, environmental impact and safety can be prioritized as requested.



02



## Managing road transport

### Dynamic tolling

With a perceived higher risk on public transport, in some cities the number of car trips has significantly increased. To rebalance the system, more sustainable mobility options as well as smart demand management will be required. The implementation of dynamic tolling solutions decreases this traffic as well as supporting much-needed resource in budget-constrained environments.

Dynamic tolling solutions enable cities to implement measures like environmental traffic management, peak-hour pricing, clean air zones or congestion charging.

Siemens Mobility has a strong record in tolling systems - involving multiple technologies, such as on-board-unit-based or fully video-based - and currently pioneers the next generation of dynamic Road User Charging (RUC) technology for cities with a “bring your own device” solution, enabling drivers to easily understand and pay the current charges – which are defined according to the cities objectives.

Any Siemens Mobility tolling solution can be dynamically tailored to a city's requirements, and, depending on the chosen technology, supports different charging structures according to the actual distance traveled by a

vehicle, the type of vehicle and other parameters such as traffic demand or ambient pollution levels.

Dynamic tolling provides the basis for impactful and efficient traffic demand management – and in the case of “bring your own device”, without the need for significant hardware investment.

### Case study

In 2019, the Mayor of London launched the world's first ‘Ultra Low Emission Zone’ (ULEZ) in the existing Central London. The purpose of the Congestion Charge Zone in London is to improve air quality. ULEZ operates 24 hours a day, every day of the year. Vehicles must meet strict emission standards to drive in this zone. The system uses a network of Automatic Number Plate Recognition (ANPR) cameras to enforce compliance. Older, more polluting, non-compliant vehicles are required to pay a daily charge or incur a penalty charge.

After six months of operation, NOx emissions from road transport in the central zone had reduced by 31 per cent and CO<sub>2</sub> emissions from road transport had reduced by 9,800 tons.







## Efficiently disinfecting assets

### UV-based disinfection services

While a train is maintained in the depot during a regular check, many technicians use the same tools to work on the tasks required. They also work in high-touch areas. Sending in cleaning teams before maintenance work can start is a time-consuming task and for the technicians to use disinfection fluid at every step of the process also adds significant time.

UV light helps to rapidly disinfect surfaces in a dry, sustainable and safe way as it is a completely chemical free. Using a handheld UV disinfection device, the technician irradiates the surface of the specific tool using UV light. Siemens Mobility offers the all-in-one service solution for your workflow and maintenance schedule.

For smaller, larger or multiple objects, a 360° UV disinfection chamber can be used to irradiate and disinfect. Objects placed in this chamber are cleansed within just 30 seconds. This makes it time-efficient and allows for the disinfection of all shapes and sizes.



*We are well placed to help our customers, partners and governments assess and implement solutions that help our industry to operate efficiently, economically and sustainably – whilst mitigating risk.*



## Qualified support from a distance

### Remote service solutions

The mobility industry is a global one. Often trains are required to be transported from other sites, suppliers may be based in different locations and support may be required from an expert. To date this has with needed at least one person to travel to site.

Remote maintenance facilitates the execution of, for example, a maintenance task by connecting an onsite technician with remote assistance. The technician uses a water and shock resistant and dust tight helmet camera which shows what he sees in real-time and complies with all health and safety requirements.

The expert provides guidance during the works and is able to support with more information and data remotely. This can be done to enable tasks and activities such as train commissioning, acceptance, warranty, maintenance and operation – this includes supplier qualification, first article inspection or factory acceptance tests.

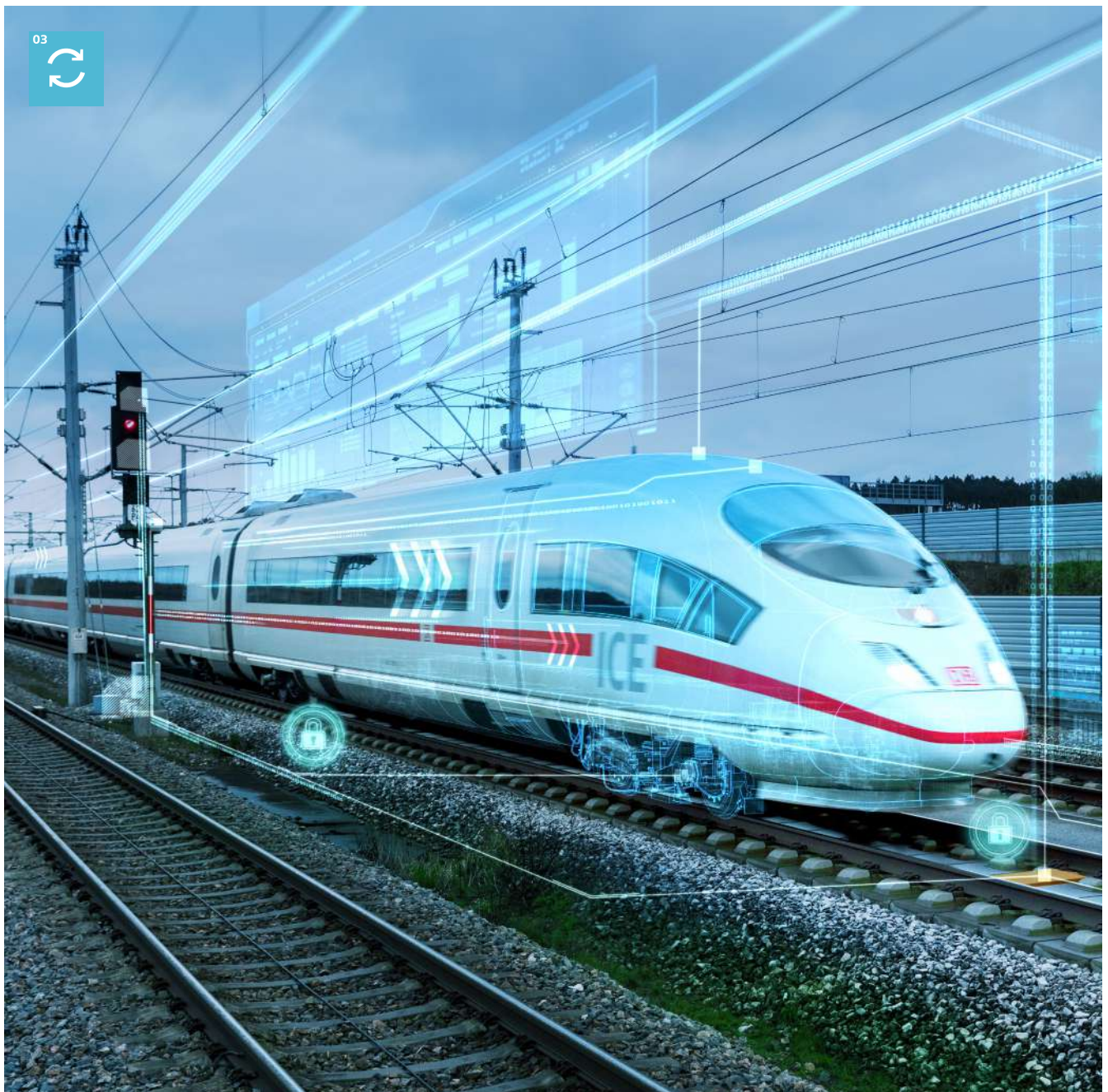
Remote maintenance offers the same high-quality result but with less travel cost, more flexibility and better efficiency. Immediate reaction times and an accelerated problem resolution leads to better first-time fix and shorter repair time. Above all it reduces the number of peoples at site to prevent infection.

### Case study: Virtual train inspection for SBB Cargo International

The employees of SBB Cargo International from Switzerland were unable to personally inspect their four new Vectron locomotives. The ownership of vehicles is only transferred after a comprehensive inspection, which takes several days and checks functionality, technology and quality of workmanship. During the digital transfer, a technician wore data goggles prepared by Siemens Mobility. Controlled remotely by the customer, the technician worked through all important points together with the inspector on site. After static and dynamic tests, the four locomotives were transferred to Basel on schedule.







## 100% availability

### Predictive maintenance

Before the COVID-19 pandemic, passengers used public transport in a fairly predictable manner, with associated data in times of high demand generally available. Now, passenger needs and demands are different. For some working from home is a mode they will follow more often, others try to avoid peak times, and some have limited their travel to relatives and friends.

Obtaining and analyzing associated data is vital for operators to optimize their maintenance schedule.

Thanks to condition-based monitoring, data analysis and predictive maintenance concepts it is possible to analyze and optimize these. Downtime can be improved by implementing additional features and add ons. The Siemens Mobility application suite Railigent® – powered by MindSphere – generates insights on operator's rail data to provide more easy to understand insight. While it may be unprecedented times for public transport the goal of up to 100% availability remains intact.





## Optimizing the value of mobility assets

### Sale and lease-back models

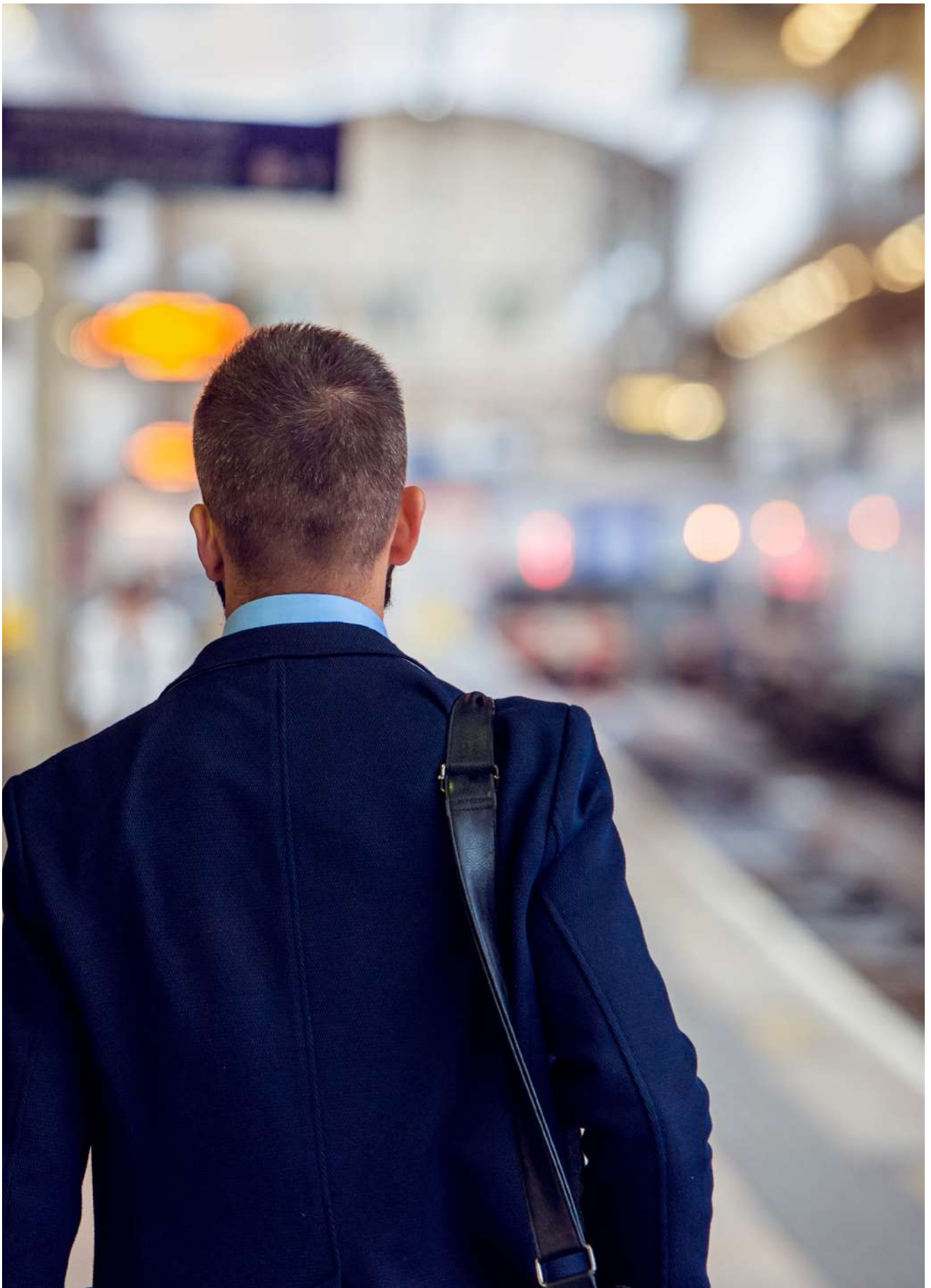
The COVID-19 related dip in mobility demand also poses risks for the financial viability of operators. Siemens Mobility has individual financing and service offerings which provide immediate access to liquid capital.

This includes the purchase of existing mobility assets at market rates, fleet modernization options including lifetime extensions according to demand and expert fleet maintenance services.

It also offers the potential to create a lease-back agreement structure around availability payments.

For operators this leads to stable and predictable payments and a transfer of availability risks.





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The information given in this document only contains general descriptions and / or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.

