


Measure by measure



There's no time to waste: passenger transport worldwide is set to rise by around 1.6 percent each year up to 2030. This may sound harmless, but it soon adds up – after all, current statistics show that almost 1,000 billion passenger-kilometers are traveled each year in Germany alone. This kind of increase cannot be managed by having even more cars on the roads. More and more people within the catchment areas of cities and metropolitan areas are already using trams, subways and suburban trains for their daily commutes to work as well as their shopping and leisure journeys. However, even public transport capacities can rarely be expanded to the extent necessary to match demand. So how can a growing influx of passengers be managed comfortably, economically and safely? The solution is automation.



More and more people are using public transport in urban catchment areas.



Metro in Guangzhou: semi-automated for energy efficiency.

The traffic burden in urban catchment areas is reaching dramatic proportions all over the world; in cities such as Munich, London or Bangkok this has been apparent for some time. Although subway and metro trains are among the most advanced means of transport out there, they often struggle to cope with the constantly rising numbers of passengers. Systems suppliers such as Siemens are therefore increasingly looking to automation technologies in order to allow more traffic to pass along designated routes without compromising safety. And because computers perform certain actions more quickly and precisely than humans, automatic train control systems are increasingly being employed for controlling, monitoring and coordinating train operation.

The extent to which the performance of a metro or subway train can be improved in practice also depends on the level of automation (see info box on page 15). Some semi-automated systems display current driving instructions to the driver on the operator console and continuously monitor the permitted train speed. Others automatically complete the journey between two stations or even take over train operation entirely as a driverless system. The fact that passengers can be even safer in such trains than with a driver made of flesh and blood is thanks to, among other things, the proven principle of automatic block signaling. If trains are traveling one behind the other on the same route, they have to constantly keep a safe minimum distance apart.

Moving block keeps trains in motion

With the classic method, called the fixed block method, the route is divided into fixed “blocks.” When train 1 enters such a block, stop signals bar any following trains from entering this block. Only when train 1 has left the block again is the next train allowed to enter. The modern moving block method, on the other hand, works with the current position of the train rather than just the block it is in. The position is transmitted by the vehicle itself to receivers along the track. If the length of the train is also measured, as is the case with mass-transit systems such as metros and subways, the estimated braking distance – and thus the actual safety clearance required – can be calculated very precisely. Therefore, the next train does not have to wait at the start of a blocked section; it can drive at a safe distance behind the first train. Trackside signals are no longer required (see info box on page 16).

With Trainguard MT, the modular train control system from Siemens, the moving block principle makes headways of just 80 to 90 seconds possible – allowing the capacity of an existing metro line to be increased by more than 50 percent. No wonder Trainguard MT is now the most popular train control system, used by over 20 metro operators worldwide.

The Chinese capital Beijing is one example. Here, in the run-up to the 2008 Olympic Games, the 25-kilometer subway Line 10 between Wanliu and Jinsong and a 6-kilometer branch to the Olym-



The U-Bahn in Munich is highly valued by passengers.

pic Park were constructed from scratch and equipped with the latest control and safety systems. Thanks to Trainguard MT, moving block technology in combination with continuous bi-directional data communication by WLAN radio could be installed for the first time in the Beijing Subway network. This not only means short headways, it also allows the system to react quickly to the current passenger volume.

The fact that Siemens has given its automation platform a modular design also brings other benefits: Trainguard MT uses standard interfaces and is scalable, which means that it remains highly flexible in case infrastructure is upgraded or refitted. For instance, a system that has been previously installed once can simply be adapted to new requirements or subsequently upgraded step by step from supervised operation to semi-automated and even driverless operation. This was the case with New York City Subway's Canarsie Line, which dates back to the 19th century when steam trains traveled between East New York and the Canarsie Pier. In 2006, this was the first place in the world where Siemens completed such an upgrade. Though the process was hardly noticed by the passengers, it is remarkable in certain respects: For one, the line was upgraded from conventional signal technology using the fixed block method to automatic train control with moving blocks. Furthermore, in the transition period trains were in operation both with and without Trainguard MT components. The trains

Computer colleague in the next seat

The various levels of train automation in public transport systems:

Driver-controlled operation



- No assistance systems
- Driving by sight

Semi-automated operation



- SCO – Supervision and Control Train Operation
- Manual driving and braking
 - Supporting displays in the driver's cab
 - Continuous speed monitoring



- STO – Semi-automated Train Operation
- Manual departure and braking
 - Automatic driving between stations
 - Automatic stopping and opening of doors

Driverless operation

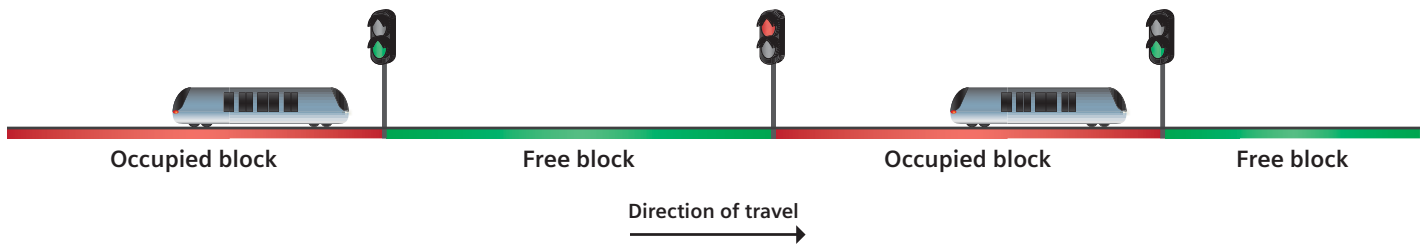


- DTO – Driverless Train Operation
- No driver required
 - Train attendant can intervene in emergency situations
 - Operation is automatically controlled and monitored

UTO – Unattended Train Operation

- Designed for operation without a driver or train attendant
- Operation is automatically controlled and monitored

Fixed block



Kept at a distance

If several trains are traveling one behind the other, line blocks ensure that they remain a safe distance apart.

With the classic method, known as the fixed block method, the line is divided into fixed sections which are guarded by stationary sig-

nals. When a train drives into a block, the entire length of the block is barred to all other trains by the rearward signal. Only when the front train is known to have left this block is a following train permitted to enter it. These fixed blocks have a significant influence on headways.

are controlled via radio using Communication Based Train Control (CBTC).

In Finland the transport authority of the city of Helsinki (Helsingin Kaupungin Liikennelaitos, HKL) has given Siemens the initial task of modernizing the existing 21-kilometer, 17-station metro line. In this case, not only the metro line but also the train depot is being automated without any interruption of service. The entire system has been designed to cope with temperatures as cold as -40°C. In 2013 the first 51 automatic trains, which can also be coupled with the existing trains, will go

into operation. By 2014 a new line in the neighboring city of Espoo is to be ready for operation: 14 kilometers in length, with seven stations and also equipped for driverless operation.

The computer takes control

Indeed, computers are increasingly taking on the task of controlling subway trains – even when the operators do not wish to completely do without human drivers. Experience shows that computer-calculated processes seldom function at their opti-



U-Bahn control center in Nuremberg: the U2 does not need a driver. Soon the metro in Helsinki will be driverless too.