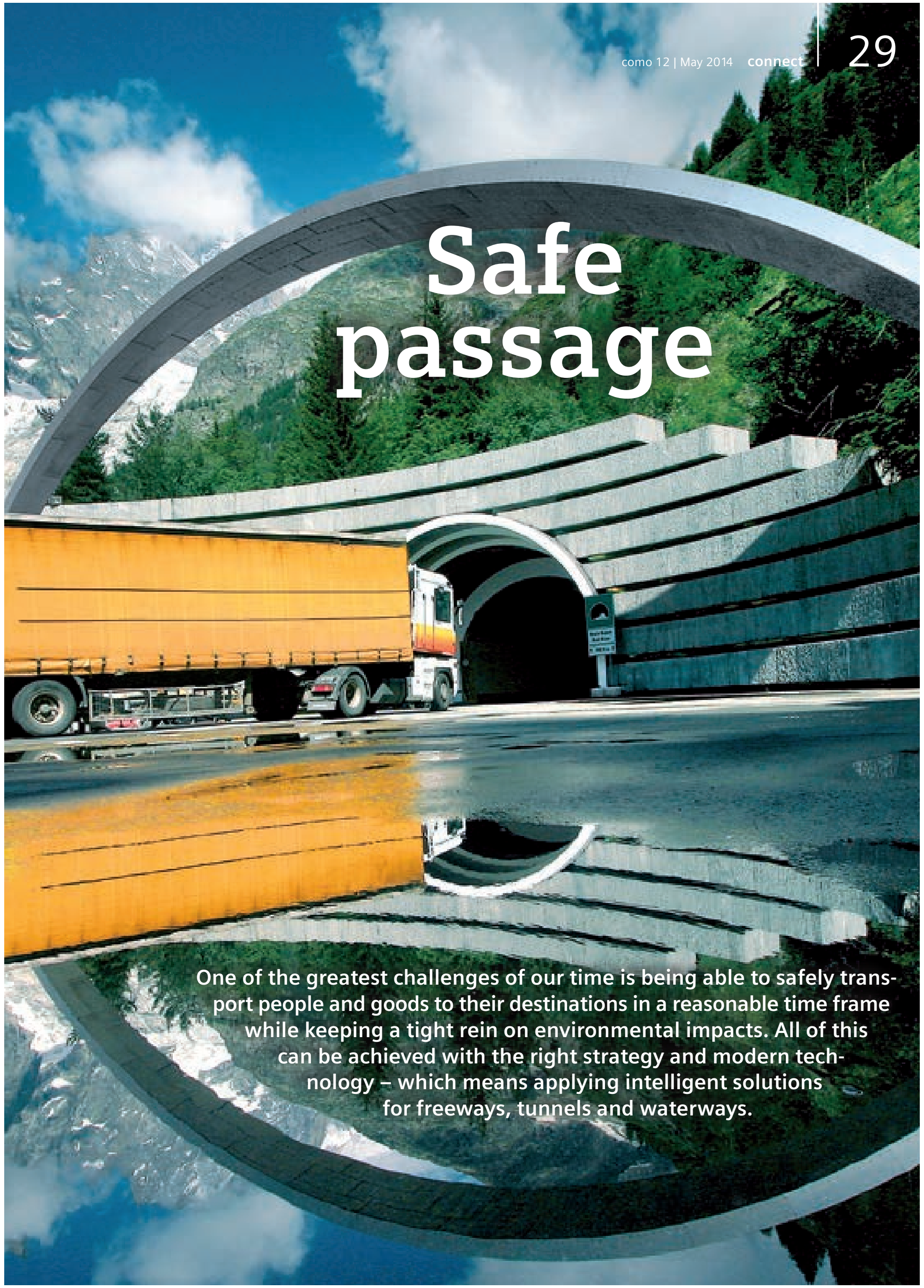

Safe passage

One of the greatest challenges of our time is being able to safely transport people and goods to their destinations in a reasonable time frame while keeping a tight rein on environmental impacts. All of this can be achieved with the right strategy and modern technology – which means applying intelligent solutions for freeways, tunnels and waterways.

Often there appears to be no way out of the dilemma: the traffic volume is constantly rising, the number of transport routes is limited, and the space and financing required for major expansion are rarely available. Nevertheless, it is possible to keep traffic flowing freely on existing routes while minimizing holdups, accident rates, fuel consumption and emissions. Intelligent transport systems enable a healthy balance between the demands of greater mobility, safety and the environment. This principle applies to all transport routes, whether on land, water, in the air or under the ground.

Greater safety on busy roads

The major effect that intelligent traffic information and guidance systems can have on the road is shown by the statistics on highly frequented freeway sections such as the A9 between Munich and Nuremberg. Here the accident numbers fell by 35 percent after the systems installed by Siemens went into operation. The statistics show around 31 percent fewer injuries and 30 percent fewer accidents resulting in serious personal injury.

Wherever this technology is in use around the world, not only do the accident rates go down, holdups are also reduced and the capacity of the roads rises significantly. This also has benefits for the environment, since fuel consumption and emission content are particularly high in stationary traffic. Once traffic is flowing again, consumption falls by up to 20 percent compared to stop-and-go traffic, while emissions of poisonous carbon monoxide (CO) and nitrogen oxide (NO_x) are reduced by up to 33 percent and 50 percent, respectively.

1 Hubertus Tunnel, The Hague
2 Tunnel control center, Waterwolf Tunnel
3 Autobahn 9, Munich

Detectors supply the data

The first step in any traffic management system is to collect certain basic data: traffic density and speeds, air pressure, humidity and other weather parameters. For each of these tasks there are specific sensors and detectors – even for recognizing broken-down vehicles. So-called outstations, which belong to the Siemens Sitraffic product family, translate the data from the sensors and detectors into control impulses for the variable message signs.

This process relies on a proven and widely applied technology that complies with the applicable standards (for example TLS in Germany) and even sets the norm in some countries. The safety-check routines of the Sitraffic outstations actually go beyond the standard industry requirements. For example, lamps and LED chains are monitored not only in ON, but also in OFF state. This ensures that rarely used but essential safety components such as warning signs and signals will definitely work when they are needed.

An extra lane expands road capacity

Here is one way of effectively minimizing the typical morning and evening congestion around cities: during heavy traffic the hard shoulder is made into an additional lane and opened for general use by automatic variable message signs – for example on the freeway ring to the north of Munich, on the A8, A9, A99 and A73. In Holland this is referred to as a rush-hour lane, while the Bavarians have opted for the more bureaucratic "Seitenstreifenfreigabe" ("opening of hard shoulder").

If tolls are also allocated to certain lanes, as on Highway 1 between Jerusalem and Tel Aviv (see como 09/2012), the Sitraffic Dynafee module can be employed: its dynamic algorithm calculates a variable toll depending on the traffic density. This evens out the flow of traffic and gains a high level of acceptance from paying drivers thanks to the "performance-related" costs.

Regulated inflow gets traffic flowing

Not every bottleneck can be dealt with in the same way. Another approach is to regulate the inflow of vehicles depending on the situation, thereby significantly increasing the capacity and traffic speed on the main route. This method has proven effective for congested urban areas such as the main route into Potsdam (see como 11/2013) and for freeways, too: in the Limmat Valley, northwest of Zurich, a ramp metering system has accelerated the traffic flow on the main route by up to 25 percent. This Swiss solution is particularly successful because it takes into account the overall traffic situation as well as several several consecutive ramps – managed by an integrated freeway control system.

Safety for bridges

Certain bridge constructions also require particular measures. For instance, Siemens has been hired as a general contractor to equip the three-kilometer, six-lane freeway bridge at the east end of the Marmara Sea in Turkey with the latest traffic control technology. When it opens in 2015, it will be the fourth-longest suspension bridge in the world, forming part of a 420-kilometer freeway between the cities of Istanbul and Izmir in western Turkey. Alongside the usual traffic management, communications and camera technology, energy supply and lighting, this project demands particular monitoring technology, as the region is subject to earthquakes. Integrated sensors are therefore installed to monitor the stability of the local infrastructure. They continuously deliver data on the status of parts and components to the integrated operation and control center.

Traveling safely underground

If kilometer-long suspension bridges are remarkable works of civil engineering, the same could certainly be said of tunnel constructions. Underground roads are almost incomparable to normal routes: the traffic area is smaller, the space available above and to the sides is limited, there is no daylight, and drivers face the unfamiliar situation of having virtually nowhere else to go if there is a hazard up ahead. Despite all this, in tunnels with modern technology installed to monitor the traffic and ensure that it flows smoothly, the safety risk these days is hardly any higher than on the open road. What is more, no other area of transport infrastructure makes construction companies and operators meticulously adhere to so many safety categories, guidelines and standards.

Technology that never misses a trick

Modern safety equipment such as the Sitraffic ITCC tunnel control center use CO and NO_x sensors in conjunction with visibility monitors to continuously monitor the air in the tunnel. If any thresholds are exceeded, the system can automatically close the tunnel. Automatic fire detection systems can precisely locate in which section a fire has broken out. Cameras with pan/tilt drives or special lenses can see from every angle. They broadcast live to the screens of the tunnel operators and can detect both smoke and traffic disruption. The personnel in the tunnel-control center are supported with information and prioritized messages, enabling them to intervene quickly and correctly should the need arise – and if necessary they can relay important information directly to drivers via the tunnel speakers or car radios.

Siemens has been equipping urban and rural tunnels in this way for over 35 years. One of the first major tunnel projects was the 15-kilometer Arlberg tunnel in Tyrol in 1978. Siemens has also carried out one of the most advanced projects worldwide: the 350-kilometer

Black Sea highway in Turkey, with a single operation center coordinating all control and monitoring processes for its 29 tunnels. The system incorporates not only traffic management but the entire operational equipment, including lighting, ventilation, energy supply and distribution, fire detection and firefighting. Seven substations are also able to control their sections independently in case of an emergency. A special video surveillance system in over 20 of the longer tunnels detects obstructions, stationary vehicles, wrong-way drivers, pedestrians, hold-ups and other dangers.

The latest technology for tunnels old and new

Still under construction is the tunnel under the new district of Leidsche Rijn, west of Utrecht, at a length of 495 meters and a width of 22 meters. Siemens will provide the entire road and tunnel control system along with the communications and automation systems. As the largest urban construction project in the Netherlands, Leidsche Rijn is being built on an area of around 20 square kilometers. The district will provide places to live and work for around 100,000 people and is due for completion in 2015. The city tunnel is being created next to the existing A2 highway tunnel, one of the most important north-south connections in the Netherlands.

Even existing tunnels can be systematically brought into line with the latest technology. For instance, Siemens completely re-equipped the 20-year-old, 1.8-kilometer Aberdeen Tunnel on Hong Kong Island with state-of-the-art LED and prismatic traffic signs. It is also permanently monitored by video cameras that are able to detect accidents and hazards. The Seelisberg tunnel in Switzerland, a 9.25-kilometer underground

Modern waterway management in the Dutch province of Zeeland: several sluices are centrally controlled; video walls in the control center display the on-site situation.

route built on the banks of Lake Lucerne in 1980, was also completely modernized a few years ago. The work was completed flawlessly while the tunnel remained in operation.

Perfect timing for sluices

In some countries waterways also play a vital role – the Netherlands is a prime example. Here a waterway network with a total length of around 5,000 kilometers accounts for over 44 percent of all goods transport, compared to just under 13 percent in Germany. In the Dutch province of Zeeland the waterways are absolutely critical, as almost half the surface area of the province (1,159 square kilometers) consists of water. This makes it all the more important to bring this infrastructure into line with the latest technology, so that water transport can be carried out as smoothly and economically as possible. Centrally controlled sluices and bridges are key requirement here, as the romantic days when lockkeepers would sit in their little houses day and night waiting for cargo barges are long gone.

The Dutch Ministry of Transport, Public Works and Water Management (Rijkswaterstaat) has therefore set itself the goal of having a central control and monitoring facility for all sluices, drawbridges and swing bridges in the province of Zeeland. Siemens is responsible for the automation, electrical installation and engineering of the first sub-projects. The end result will be a modern water transport management system featuring open corridors ("green waves") and 24/7 operation.

Transport management on the water

These days, to ensure safe operation around the clock and to reduce running costs, several sluices are integrated on the technical level and controlled and monitored from a central location. This enables several ships to pass through a sluice as a group (cluster), which has benefits all around. Clustering reduces waiting times and overall trip duration for the ships, and the locks do not have to be moved as often.

A central control system makes it relatively easy to organize these clusters. Since the operators of all sluices in Zeeland are now working out of a single control station, it is easy for them to coordinate their decisions and establish a logical system of "traffic management" on the water. For directly monitoring the situation at the connected sluices, the control station personnel rely on large video walls displaying the video material from the local camera systems. Uniform technology and user interfaces throughout the province simplify the operators' work.

For the time being, true "tracking and tracing" of shipping vessels remains a vision, but Siemens is working on it – and sluice automation is an important step toward this goal. ■