

# Effective and efficient tunnel monitoring

In order for drivers to travel through tunnels safely, visibility and a continuous breathable air supply are crucial. Therefore, tunnels require sensors that cooperate with the control system to ensure the correct lighting and air conditions, both during normal operations and in the event of an incident.

Besides maintaining safety through the tunnel, tunnel operators are also responsible for ensuring the tunnel operates reliably and efficiently. Sensors need to deliver correct and reliable measurements, and they should be durable and easy to maintain too.

"For nearly 30 years, we at JES – since 1990 – have devoted ourselves to providing sensor solutions for tunnels that achieve a low lifecycle cost for tunnel operators," says René Jung, managing partner at JES. "In the past we have focused on supplying to German speaking countries. Having established an international sales organization with our partner Durag, we will now bring the modern sensor technologies we have introduced to Austria to other regions of the world."

## Earlier fire detection

The big tunnel fires in the Alps around the millenium, such as the Mont Blanc tunnel fire in 1999, showed the importance of detecting fires as early as possible to prevent more vehicles from entering the tunnel and to maximize the time for self-rescue for those who are already in the tunnel. Fire incidents happen more often than expected and are usually caused by technical problems like overheated engines, locked brakes or faulty turbochargers. "All of these problems result in a rapid and drastic decrease of visibility



Above: Luminance meters adapt lighting in tunnels to their surroundings. For example, to daylight or dark at the entrance/exit

Left: Only cross-section flow meters deliver most reliable results to precisely regulate the air flow in a tunnel especially in case of a fire

## Need to know

### JES creates sensor solutions for road tunnels, including:

- > Luminance and illuminance meters
- > Traffic signal controllers
- > Gas sensors
- > Air flow measuring systems
- > Visibility monitoring systems
- > Road weather information systems

in the tunnel," says Jung. "This makes visibility sensors the first tunnel sensors to reliably detect a fire – long before linear fire alarm cables or video detection systems respond."

It is, of course, in tunnel users' and operators' interests for visibility sensors to operate reliably. Many tunnels still use sensors that measure the optical transmission along a path. As an alternative, JES promotes scattered light visibility sensors that deliver reliable results and require little cleaning or maintenance. Only a single device needs to be mounted

instead of a precisely-aligned transceiver and reflector. The sensors' optics are not exposed to polluted tunnel air, so collected data is not affected by it.

## Air flow monitoring

After a fire incident has been detected, it is crucial to control the ventilation in a way that allows drivers to flee without being suffocated by the smoke. A precise and fast-responding air flow measuring system is required. In 2013, a study published by the Swiss Federal Roads Administration revealed that only systems measuring the air flow over the cross-section of the tunnel deliver results with only small deviations from the average air flow.

"We are very proud that our system could achieve the highest rating in the summary," says Jung.

## Energy savings

During normal operation, good visibility in a tunnel is achieved by appropriate tunnel ventilation control, but even more by the tunnel lighting. It needs to be well controlled to allow drivers to safely approach and pass through the tunnel,

both during the daytime and at night time. The lighting placed at the tunnel entrance should also be adequate in order to avoid a black hole effect when a driver enters the tunnel.

Luminance meters are the sensors of choice for controlling tunnel lighting in the access, threshold and interior zones. Measuring the luminance in the access zone outside the tunnel has become a standard practice in many countries. However, hardly any tunnel operators outside of the Alpine regions also use luminance meters inside the tunnel.

Modern LED tunnel lights can easily be dimmed. Employing luminance meters inside a tunnel to measure actual lighting levels allows lighting to be dimmed to required levels, thus reducing energy consumption and extending the life time of the luminaires. ○

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