Like many 21st Century cities, Stockholm has suffered in recent years from both increasing volumes of traffic and an increasing population that have put ever greater strains on its infrastructure.

In the 1990’s the various municipal bodies that govern the city agreed on a semi underground ring road for Stockholm, a massive engineering project that would involve tunnelling under the suburbs of the city to provide roads that would otherwise have to be built through housing, office and park land above ground. To help with the surveillance and safety system on the Södra Länken stretch of the project, leading Swedish CCTV company ISG approached UK firm AMG Systems.

The Södra Länken tunnel is a key stretch of the Stockholm ring road and the largest ever road tunnel construction in Sweden.

Along its 6km length it interconnects with 5 other roads to create a 17km long mass of tunnels and ramps. Work on Södra Länken commenced in the mid 1990s and the complex opened in 2004 to carry around 60,000 vehicles a day.

Swedish CCTV firm, ISG, was responsible for installing the traffic surveillance system for the tunnel complex, involving more than 400 cameras relaying video signals to 'Trafik Stockholm'.

This permanently manned traffic management centre monitors traffic ‘rhythms’ to ensure a smooth flow of traffic and an overall safe journey for the public. However, in the event of break downs, gridlock or accidents, Trafik Stockholm coordinates emergency support for drivers in the tunnel. The video feeds are also used for a ‘traffic incident detection system’ and this posed a problem for ISG. "Incident and
emergency management requires a highly detailed, colour
image for the control room staff while the detection system is
optimised to work with higher contrast monochrome images.
We were faced with installing and maintaining 2 cables from
each of the cameras - a large capital investment and a
continuing running expense”, says Matts Lilja, Managing
Director of ISG.

Two other considerations also had to be thought through in the
selection of the video transmission equipment. The first arose
from the way that tunnel cleaning is carried out - via high pressure
washing. ISG had a tested and proven waterproof camera housing
and any ancillary equipment that could not be put inside the
camera housing would need its own waterproof housing.

Secondly, reliability was paramount. “Once operational, getting
access to the equipment inside the tunnels to make adjustments
or replace failing equipment isn’t a viable option”, says Matts.
“Zero fault operation is what we had to strive for”.

To help them out, ISG approached UK based AMG Systems to
design, supply and install the fibre optic transmission
equipment that would be crucial in the safe operation of the
road. “At first sight, our AMG 2000 range appeared to be the
ideal fit in the Södra Länken,” says Alan Hayes, Managing
Director of AMG.

“Its single channel transmission technology offers a highly cost
effective solution for Local Area Systems where all the cameras
are within a few kilometres of the control room. It is also
exceptionally reliable. However, after investigating the camera
and housing, we proposed a custom solution based on the
standard AMG2000 range that would overcome both the need
for twin fibres to each camera and the need for additional
waterproof housings”.

AMG’s final solution involved designing a camera end PCB to
generate the colour and monochrome signals, both of which
would be carried down a single fibre to the Trafik Stockholm
facility where they were separated for incident monitoring
and number plate recognition. This was integrated with the
AMG 2000 equipment at the camera to provide a low cost
video transmitter and data transceiver, all of which could be
accommodated within the existing camera housing.

At a stroke, the fibre infrastructure was halved and cleaning
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“Two Into One Cleans Up

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“One of the entrances to the 17km network of tunnels

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Installing and Commissioning

“Coming up with the idea of combining the video streams and customising a longstanding standard range to easily accommodate the changes without affecting our ability to support the product over its lifetime wasn’t the most challenging part of the project”, says Alan. “Installing the fibre was, as we worked alongside many other contractors whilst construction vehicles and tunnelling equipment were still in action”.

The answer was to manufacture a set of demountable test equipment that could be used to test each fibre optic link as it was installed. Each fibre run was tested using the temporary rig and then sealed for the remainder of the construction process, ready to have the final camera housing installed at final fit out. “This worked very well”, says Alan. “We were able to progress the fibre installation whilst other heavy construction continued and minimise the danger of damage from passing lorries and heavy machinery. As you can imagine, that was an inconvenience and expense we were eager to avoid!”

A final consideration for the AMG network was that the cabling should be resilient - both fire and waterproof. Although, in the event of an accident, visibility from the camera would probably be impaired by smoke it was crucial that the network lasts as long as possible to relay information back to aid coordinators on the ground.

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Highlights

• Total of 400 cameras on Sweden’s largest road tunnel

• Total complex is 17km and carries over 60,000 vehicles every day

• Colour and monochrome feeds required from each camera

• Both signals carried down single fibre to the Trafik Stockholm control room with huge reduction in infrastructure costs

• Custom solution developed based on the standard AMG2000 range, involving a camera end PCB to generate the colour and monochrome signals. It provides a low cost video transmitter and data transceiver, all of which is accommodated within the existing camera housing

• Camera and transmission equipment had to fit inside bespoke waterproof housings that had been tested to withstand the tunnel cleaning equipment

• Combining the whole transmission and camera assembly within a single housing also enables rapid replacement of failed units

• Demountable test equipment developed so that cable runs could be installed and tested as the tunnel was dug ready for final fit out

• The video signal is not compressed. This ensures that video quality is not compromised and latency is eliminated