

WHY RADAR IS THE PREFERRED TUNNEL INCIDENT DETECTION SYSTEM IN THE RENNFAST TUNNELS



Kristian Jensen,
Multiconsult, Norway.
kristian.jensen@multiconsult.no

Abbreviations:

VTS: Vegtrafikksentralen. Road traffic center.

AID: Automatic Incident Detection. Used for analyses and automatic incident detection.

Rennfast: The tunnels Byfjord- and Mastrafjord, E39. The road connections from mainland to the Island Rennesøy. Include road and a bridge between the islands Sokn and Askje

TERN: Trans-European road network

ÅDT: The average day traffic during a year.

Rennfast:

Supervised by: VTS, Bergen 150 km north of the tunnels.



www.norgeskart.no

The section includes
2 tunnels:

Byfjord: 5,9 km

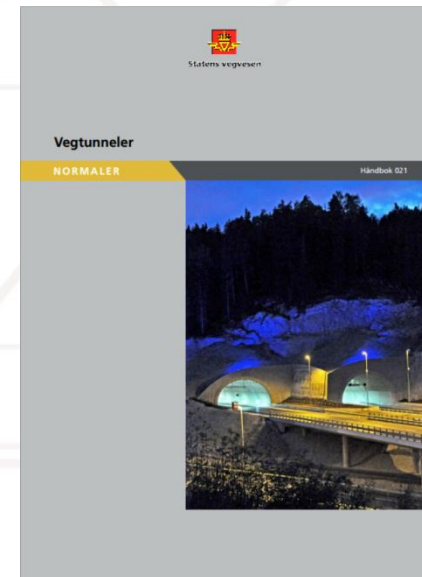
Mastrafjord: 4,4 km

The tunnels average
daily traffic (ÅDT) is
around 9000 vehicles.

TERN:

This road is a part of the European TERN.

Upgrading of the control system for the tunnels requires automatic incident detection and CCTV, according to EU-Directive and the Handbook number 021 from the Norwegian Public Roads Administration (Statens Vegvesen).



The reason:

VTS did not want Automatic incident detection by video, due to the fact that VTS is struggling with many false alarms and unwanted alarms caused by dust, insects, reflections etc.



VTS decided another alternative was needed, and Multiconsult was asked to find an alternative solution.

Alarms:

Three definitions of alarms: Normal alarm, false alarms and unwanted alarms.

False alarms: Alarms triggered by errors, or by other incidents than the alarms are actually configured for.

An unwanted alarm: An incident which doesn't need action, but take attention.

Open Alarm Sources				8 Sources / 55 Alarms		
Timestamp	Source State	Ack State	Source	Alarm Class	Priority	Message
11-Sep-13 12:26:31 PM CEST	Offnormal	0 Acked / 2 Unacked	DivAlarm.Feil_nodlyssentral\$2eAlarm	Alarm Prioritet 1	1	Alarm
11-Sep-13 12:13:40 PM CEST	Offnormal	0 Acked / 2 Unacked	%err:alarm:AlarmRecord:err:baja:Station:name%.DivAlarm.Feil_Brann\$2eAlarm	Alarm Prioritet 1	1	Alarm
13-Sep-13 10:36:17 AM CEST	Normal	0 Acked / 23 Unacked	SDCSite.Soner.Temp_Lav_RT604\$2eAlarm	Alarm Prioritet 1	31	Ok
13-Sep-13 10:36:17 AM CEST	Normal	0 Acked / 5 Unacked	SDCSite.Soner.Temp_Lav_RT602\$2eAlarm	Alarm Prioritet 1	31	Ok
13-Sep-13 10:36:17 AM CEST	Normal	0 Acked / 6 Unacked	SDCSite.Soner.Temp_Lav_RT605\$2eAlarm	Alarm Prioritet 1	31	Ok
13-Sep-13 10:36:17 AM CEST	Normal	0 Acked / 10 Unacked	SDCSite.Soner.Temp_Lav_RT601\$2eAlarm	Alarm Prioritet 1	31	Ok
13-Sep-13 10:36:17 AM CEST	Normal	0 Acked / 6 Unacked	SDCSite.Soner.Temp_Lav_RT603\$2eAlarm	Alarm Prioritet 1	31	Ok
29-Aug-13 5:02:52 PM CEST	Normal	0 Acked / 1 Unacked	DivAlarm.Feil\$20n\$f8dlyssentral\$2eAlarm	Alarm Prioritet 1	31	Ok

The tunnels:

Both tunnels have one bore that includes 3 traffic lanes on inclines, and two lanes on the level sections. The walls of the tunnels are mainly of a rough texture and left in a natural rough rock finish.



Number of alarms:

VTS in Bergen is responsible for one tunnel with AID using analyses by video, this is called “Knappetunnelen”. In Knappetunnelen there are around 100 cameras with AID. There were 6024 alarms in the period from 01.08.2012 to 31.01.2013, which are around 32 alarms per day.

2-3 alarms required action from the operators.

VTS-staff in Bergen are already struggling to manage the job because the disproportional amounts of alarms are disturbing for other tasks, especially when it is critical incidents and rush hour.

False and unwanted alarms lead the operators’ attention away from more important tasks.

Challenges:

Facing a the Rennfast tunnels coming up with 160 cameras with AID, VTS feared that the amount of alarms will be unsustainable. AID systems can be adjusted and fine-tuned to less alarms, but for the Rennfast VTS wants an alternative with less alarms.



Alternatives:

Not many alternatives to video detection.
We came up with 2 alternatives:

Loops in the road in a combination with smoke detectors

We were skeptical to limit the level of detection.

Radar incident detection.

Possibility to detect almost the same as video.

Then we started to focus on detection by radar.

Radar incident detection:

We had been informed that Trafikverket in Sweden (Road Authority in Sweden), had installed radar incident detection in some places.



Trafikverket stated that they were very satisfied with the Radar AID, and already had ordered new radars for surveillance of a road outside Stockholm. We were informed about less maintenance and few false and unwanted alarms.

They highly recommend representatives from Norway to visit the Hinhead tunnel in UK for a closer look at the Radar AID system

Hinhead tunnel:

Inspection in Hinhead 21. June 2012



We were talking with operating staff and maintenance team.

The personnel in place had experience with different detection systems.

They were very satisfied with the system and highly recommended use of radar.

The level of maintenance and number of false and unwanted alarms were the two main reasons for their satisfaction with radar detection.

Recommendations:

After the references from Sweden and UK, we made a report where we recommended Radar incident detection.

The recommendation was due to the numbers of false and unwanted alarms and the level of maintenance of the system.

The project followed our recommendations and wanted to install radar incident detection.

Limitations and benefits by use of radar:

We have documented that there are less false alarms with radar compared to video detection.

For straight tunnels the price will be similar for video and radar detection.

Depending on the curves in the tunnel, the price can be higher.

Blind spot underneath the radar. The solution is to cover the area by using a radar overlapping the next one. Then there will be a redundancy of areas also.

To have visibility of the tunnel, there has to be CCTV mounted. The radar system can be integrated with the CCTV system.

Limitations and benefits by use of radar:

Detection of smoke can be difficult. But fires in tunnels with AID are normally detected with stopped vehicles, manual fire alarm or calls from road users.

The Radar has moving parts. Belts have to be changed.

The radar to be installed in Byfjord and Mastrafjord should have a Data transmission of at least 6 Mb/s. The network is designed with a 1 GB/s network with subnets to control the traffic.

The radar is a permanent installation, there will be no obstruction due to exhaust, light, reflections, dust etc. There is no need for extra cleaning.

In combination with camera, the cameras have less requirements for image quality.

Radar in Rennfast:

Detection with radar can be done in a relatively large area, we described the radars to cover 500 m radius.

The curves of the tunnel are indicative of the number of radars. In total, detection in the two tunnels can be covered by 24 (13+11) radars.

The radar system was described to operate in tunnel environment, ambient temperature area – 20⁰C to +60⁰C and relative humidity up to 100%.

Radars in Rennfast:

The installations should be mounted with consideration for easy service and maintenance, and the equipment must withstand cleaning using high pressure.

The equipment should be installed so it does not obstruct visibility or complicates service and maintenance on other installed equipment.

The radar system shall detect: Stopped vehicles, Lost load (>0,125 m³, 0,5m), Rocks/ sediment (>0,125 m³, 0,5m), Pedestrians in the tunnel and slow moving vehicle.

The radar system shall be integrated with the CCTV system for visibility of the detection area.

At the moment the system is about to be installed.





MULTICONSULT

Thank you for your attention!