INTRODUCTION

AA/ EUROTAP 2008: 31 EUROPEAN ROAD TUNNELS TESTED

For the 10th time in succession since 1999 EuroTAP's experts have inspected European road tunnels. Thirty one tunnels in eleven European countries were on the agenda of this year's test programme which got under way in January. The inspectors came home with the worst result in five years, including two ratings of poor and shockingly seven ratings of very poor. This means that every third tunnel failed to the make the grade. Ten tunnels will be pleased with their rating of very good and five tunnels with their rating of good. The seven tunnels rated acceptable, and which therefore at least fulfil the minimum standards of the EU Directive on safety in road tunnels, are also on the right path.

The honour of being the anniversary winner for 2008 goes to the 1.3 kilometre long Pont Pla tunnel which opened in 2006, in Andorra la Vella, the capital city of the tiny state of Andorra in the eastern Pyrenees between Spain and France. A negative award goes to Italy with the 2.4 kilometre-long Cernebbio tunnel, opened in 1983, in the city of the same name at Lake Como; this is the fourth Italian tunnel in succession to come last in the test. However, it was in Norway that devastating results were recorded this year. All of the three tunnels tested there came last only just ahead of the last-placed Italian tunnel.

The tunnel test was carried out within the scope of the European EuroTAP project. EuroTAP is being supported this year by the FIA (Fédération Internationale de l´Automobile) Foundation and 19 European partner clubs, including the AA which is a leading member.

TEN YEARS OF TESTING TUNNELS: A SUCCESS STORY

Tight budgets and the call for safety – these are diametric opposites that also collide in the world of road tunnels. For ten years now, the EuroTAP programme (European Tunnel Assessment Programme), initiated and co-ordinated by ADAC (the German AA), has been strongly committed to safety in tunnels. Every year, this unique and independent, methodological test programme makes safety standards visible and comparable on a European scale. And this has led to lasting success.

At the beginning of this year, European ministers and tunnel operators, EU parliamentarians and representatives of the EU Commission were invited by ADAC president Peter Meyer to witness the first European Tunnel Awards ceremony in Brussels. Mr Claude Wiseler, Minister of Civil Engineering in Luxembourg, was pleased to see the Markusberg tunnel awarded, and emphasised: "Awarding the test winners means that the technical, financial and at times political decisions which we made were right. And this motivates public authorities to continue with this work." EuroTAP is setting standards. EuroTAP is creating awareness. For

instance, in Austria where in response to the weak results of the first years a tunnel commission was formed at the Federal Ministry for Transport, Innovation and Technology (BMVIT). Other countries have also responded, for example, Switzerland: In 1999 when the San Bernardino tunnel was tested and failed with a rating of poor. This tunnel was subsequently refurbished and is now rated very good. "EuroTAP is an instrument that helps to ensure that laws in Europe governing road tunnel safety are not just a ‘paper tiger’ but that they are implemented in practice", says EU parliamentarian and rapporteur Reinhold Rack.

But a tunnel does not necessarily have to be bad in order to be given a safety check-up. The Plabutsch tunnel in Austria, for instance, was rated good in 1999. Despite this, the powers that be decided to build a second tube following the disasters in the Montblanc and Tauern tunnels. In 2005, the Plabutsch tunnel was rewarded with a rating of very good. The San Bernardino (Switzerland) and Plabutsch tunnels are just two of 282 tunnels in 20 countries which were inspected over the past ten years by independent experts commissioned by EuroTAP. These experts travelled all over the continent, from Norway to the Canary Islands, from Portugal to Slovakia, passing through more than 1,100 kilometres of tunnel, visiting tunnels from the century before last, like the Del Tenda tunnel which was opened in 1882. They also inspected sheer endless tunnels – in Norway's Lærdal tunnel, the exit portal is 24.5 kilometres from the entry portal. The inspectors travelled always with one thing in mind: human safety. They scrutinised escape facilities, ventilation and fire protection. They looked into how emergency situations can be mastered in tunnels. "A lot has happened since the early days", says Dieter Tetzner, Product Manager for Tunnel Safety at DMT and an inspector who has always been on site since the beginning. "Operators have come to realise that some things have to change.”

By 2014, and in justified cases by 2019, the minimum standards of the EU Directive must be fulfilled and this will ultimately mean considerable expenditure. By 2019, at least seven billion euro will be invested in tunnel refurbishment in the ten countries most tested up to now. In Germany alone, 550 million euro will be invested in the years to come. Italy and France will spend around two billion euro, Austria one billion and Switzerland 800 million. But where there is light, there is bound to be darkness. Just recently, the European Commission, which financially backed EuroTAP between 2005 and 2007, issued a warning to the UK and Greece, urging them to comply with the safety requirements.

Between 1999 and 2008, 26 percent of the tunnels tested failed. If we take a look at this year alone, nine of the 31 and hence 29 percent of the tunnels tested using strict criteria within the scope of EuroTAP received results that are below the minimum standards required by the EU Directive. Especially Italy and Norway, which continuously deliver the poorest ratings in the tests, highlight the necessity for the checks. So, there is still a lot to do, and EuroTAP will keep up its work. The ADAC’s Robert Sauter, who initiated the tunnel test programme ten years ago, promises: "We will continue to test tunnels and to exert public pressure via the media. The people in charge will respond with investment and tunnel refurbishment. The consequences are safe tunnels and ultimately this will benefit everybody."

INDIVIDUAL TUNNEL RESULTS

Universität Düsseldorf

EUROTAP rating: Poor

Location:	Germany, in Düsseldorf
	A 46 between Heinsberg and Wuppertal
Year opened:	1983
Length:	1,026m
Portal height level:	38 / 39m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	80kph
Vehicles per day:	70,296
Share of HGVs:	9.3%
Breakdowns / accidents / fires:	No data available/ 13/ 0
Risk:	High

Strengths and weaknesses

- Two tubes with cross-connections as additional escape and rescue routes every 80 metres
- Emergency lane along the entire length of the tunnel
- Emergency phones and fire extinguishers provided every 160 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the fire brigade is notified
- Ventilation is powerful enough to deal with a fire
- No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant
- Tunnel control centre manned around the clock by trained staff
- Radio communication possible throughout the tunnel for both the police and the fire brigade
- Rescue service vehicles can cross at the portals
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff
- Fire brigade is well-trained and well-equipped

- No traffic lights and barriers in front of the portals

☹ Traffic radio cannot be received throughout the tunnel

☹ No loudspeakers

☹ No video surveillance

☹ Traffic and traffic disruptions are not automatically detected nor is the use of lay-bys, emergency phones or fire extinguishers

☹ In the event of fire, the tunnel is not automatically closed

☹ No regular emergency drills

! Knock-out criterion! The test result was lowered from Acceptable to Poor due to the very poor result in the categories of Traffic and traffic surveillance and Communication: (refer to Methodology: How we tested).

Plans for the future

2009:

- Replacement and enhancement of the traffic systems, including a system to close the tunnel
- Installation of video surveillance, loudspeakers, traffic radio throughout the tunnel, as well as emergency phones and hydrants at the portals
- Regular emergency drills

Briefly and to the point

- The high risk found for driving through the tunnel was primarily due to the high traffic volume of more than 70,000 vehicles per day and the unrestricted transport of hazardous goods.
- Unidirectional traffic, sufficiently wide lanes, emergency lanes and lighting are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff. However, there is no video surveillance system.
- Incidents in the tunnel are not automatically reported to the tunnel control centre. There is also no traffic radio or loudspeakers to inform motorists if necessary. An automatic fire alarm system detects fires at least, activates ventilation, and notifies the fire brigade. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. At least the emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services.
- In the event of fire, there are good preventative measures in place to facilitate effective self-rescue. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone and can leave the tunnel through the clearly marked emergency exits.

Heidkopf

EUROTAP rating: Very good

Location:	Germany, near Friedland A 38 between Göttingen and Halle
Year opened:	2006
Length:	1,725m
Portal height level:	280 / 301m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	80kph
Vehicles per day:	15,000
Share of HGVs:	22%
Breakdowns / accidents / fires:	12/ 0/ 0
Risk:	Low

Strengths and weaknesses

- Two tubes with cross-connections as additional escape and rescue routes every 300 metres
- No hazardous goods transported through the tunnel
- Traffic lights and barriers in front of the portals
- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers
- Lay-bys provided every 600 metres
- Sound-insulated emergency phones and fire extinguishers provided every 150 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated, the tunnel closed and the fire brigade is notified
- Ventilation is powerful enough to deal with a fire
- Rescue service vehicles can cross at the portals
- Access for rescue vehicles to the neighbouring tube every 600 metres
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan

Regular training for tunnel staff

Regular emergency drills

Fire brigade is well-trained and well-equipped

Plans for the future

- Installation of variable information displays at the portals, impact protection in the lay-bys and speed monitoring

Briefly and to the point

- The low risk found for driving through the tunnel was primarily due to the relatively low traffic volume of around 15,000 vehicles per day and the ban on the transport of hazardous goods. However, the HGV share of 22 percent is relatively high.
- Unidirectional traffic, sufficiently wide lanes, lay-bys and lighting are the main reasons for the very good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs along with information provided via traffic radio and loudspeakers. An automatic fire alarm system detects fires, activates ventilation, closes the tunnel and notifies the fire brigade. Good training and equipment for the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone and can leave the tunnel through the clearly marked emergency exits.

Reutherberg EUROTAP rating: Acceptable

Location:	Germany, near Wolfach
	B 294 between Hausach and Schiltach
Year opened:	1993
Length:	1,256m
Portal height level:	270 / 281m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	70kph
Vehicles per day:	9,200
Share of HGVs:	15%
Breakdowns / accidents / fires:	No data available/ 0/ 0
Risk:	Medium

Strengths and weaknesses

- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Lay-bys on opposite sides every 412 metres
- Emergency phones and fire extinguishers provided every 140 metres
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed
- Ventilation is powerful enough to deal with a fire
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Regular training for tunnel staff

- No loudspeakers
- No automatic detection of traffic disruptions, nor of lay-by use
- No additional escape or rescue routes
- No evacuation lighting for tunnel escape route, nor signs showing the escape direction and distance to the portals
- Local power supply is not protected against power cuts
- Emergency response plan incomplete
- No regular emergency drills
- The maximum time of use for the fire brigade's respiratory equipment is too short

Plans for the future

2010:

- A parallel rescue gallery with eight cross connections is to be built

2011:

- New lighting, ventilation and fire alarm system, replacement and enhancement of the central control system, traffic equipment, measuring equipment, video surveillance and power supply, expansion of tunnel radio
- Installation of LEDs, loudspeakers and an automatic closing system
- Escape routes to be marked by evacuation lighting
- Installation of water retention equipment for tunnel drainage

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the low traffic volume of 9,200 vehicles per day and a tunnel length of only around 1.3 kilometres. The HGV share of 15% is, however, relatively high, as is the longitudinal gradient of 3.2 percent. And there are no restrictions on the transport of hazardous goods.
- Sufficiently wide lanes, lay-bys and lighting are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- At least the use of an emergency phone or fire extinguisher is automatically reported to the tunnel control centre by video link. Motorists are guided, if necessary, using traffic lights and receive information via traffic radio. An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. However, the emergency response plan is incomplete and there are no regular drills, so that co-operation between the tunnel control centre and the emergency services is not sufficiently co-ordinated.
- The necessary preconditions for effective self-rescue in a fire need badly to be improved. There are no additional emergency exits, there is no evacuation lighting for the escape routes in the tunnel, nor are there signs showing the escape direction and the distance to the nearest exit.

Wattkopf

EUROTAP rating: Acceptable

Location:	Germany, near Ettlingen
	L 562 Ettlingen bypass
Year opened:	1994
Length:	1,950m
Portal height level:	136 / 153m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	70kph
Vehicles per day:	20,000
Share of HGVs:	10%
Breakdowns / accidents / fires:	3/ 1/ 0
Risk:	Medium

Strengths and weaknesses

Traffic lights and barriers in front of the portals

Traffic radio throughout the tunnel, the operator can broadcast messages

Full video surveillance

Automatic detection of traffic disruptions, as well as the use of emergency phones and fire extinguishers

Lay-bys provided every 420 metres

Emergency phones and fire extinguishers provided every 150 metres

Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit

Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated, the tunnel closed and the fire brigade is notified

Ventilation is powerful enough to deal with a fire

Tunnel control centre manned around the clock by trained staff

Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade

Regular training for tunnel staff

Regular emergency drills

Fire brigade is well-trained and well-equipped

No additional escape or rescue routes

Emergency response plan incomplete

! Knock-out criterion! The test result was lowered from Good to Acceptable due to the very poor result in the Escape and rescue routes category (refer to Methodology: How we tested).

Plans for the future

- By 2010: A parallel safety gallery is to be built
- Rules to be introduced for the transport of hazardous goods

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due the relatively high traffic volume of more than 20,000 vehicles per day, resulting from bi-directional traffic, and the unrestricted transport of hazardous goods.
- Sufficiently wide lanes, lay-bys and lighting are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs along with information provided via traffic radio and loudspeakers. An automatic fire alarm system detects fires, activates ventilation, closes the tunnel and notifies the fire brigade. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. Regular drills at least co-ordinate co-operation between the tunnel control centre and rescue services. The emergency response plan, however, is incomplete.
- The necessary preconditions for effective self-rescue in the event of fire need to be improved. The ventilation system extracts smoke near the seat of the fire out of the tunnel, permitting people to go to a mostly smoke-free area, however, this is only possible via the portals which could be quite a long distance away. There are no additional emergency exits.

Arlberg

EUROTAP rating: Good

Location:	Austria, near St. Jakob S 16/ Arlberg dual carriageway, between Landeck and Bludenz
Year opened:	1978
Length:	13,927m
Portal height level:	1,255 / 1,190m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	80kph
Vehicles per day:	7,300
Share of HGVs:	13.4%
Breakdowns / accidents / fires:	32 / 1 / 1
Risk:	Medium

Strengths and weaknesses

- Traffic lights and variable information displays in front of the portals
- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers
- Lay-bys provided every 848 metres
- Sound-insulated emergency phones and fire extinguishers provided every 212 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes; doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed
- Ventilation is powerful enough to deal with a fire
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff
- Regular emergency drills
- Fire brigade is well-trained and well-equipped

☹ The emergency exits via eight cross-connections to the parallel rail tunnel are too far apart (1,650 metre)

Plans for the future

- Second phase of expanding the escape routes with a shorter distance of around 850 metres between emergency exits
- After 2012: General refurbishment of the tunnel

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the low volume of traffic of 7,300 vehicles per day. However, the HGV share totals 13.4 percent and the tunnel has a length of almost 14 kilometres and is hence very long.
- Sufficiently wide lanes, lay-bys and lighting are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and are provided with information by information displays at the portals, traffic radio and via loudspeakers. An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- In the event of fire, the necessary preconditions for effective self-rescue are relatively good. The ventilation system extracts the smoke near the seat of the fire out of the tunnel. This means that people can leave the tunnel through an area that is mostly smoke-free. The distance between emergency exits, however, is too long.

Trebesing

EUROTAP rating: Very good

Location:	Austria, near Trebesing A 10 between Salzburg and Villach
Year opened:	East tube 2006/ west tube 2007
Length:	848m
Portal height level:	724 / 740m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	100kph
Vehicles per day:	14,438
Share of HGVs:	22%
Breakdowns / accidents / fires:	1 / 0 / 0
Risk:	Medium

Strengths and weaknesses

- Two tubes with cross-connections as additional escape and rescue routes every 145 metres max.
- Traffic lights and variable information displays in front of the portals
- Traffic radio throughout the tunnel, the operator can broadcast messages (in several languages)
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of emergency lanes, emergency phones or fire extinguishers
- Emergency lanes the full length of the tunnel
- Sound-insulated emergency phones and fire extinguishers provided around every 140 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes; doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed
- Ventilation is powerful enough to deal with a fire
- Rescue service vehicles can cross at the portals
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff
- Regular emergency drills

 Fire brigade is well-trained and well-equipped

 The power supply is not protected against power cuts

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the low traffic volume of 14,500 vehicles per day and unidirectional traffic, and a tunnel length of only around 848 metres. On the other hand, the HGV share of 22 percent is relatively high, and there are no restrictions on the transport of hazardous goods.
- Unidirectional traffic, sufficiently wide lanes, emergency lanes and lighting are the main reasons for the very good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Any incidents in the tunnel are automatically reported to the tunnel control centre by video link. The system used to analyse video images also enables the fast detection of smoke. If necessary, motorists are guided using traffic lights and are provided with information by information displays at the portals, traffic radio and via loudspeakers. An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone and can leave the tunnel through the clearly marked emergency exits.

Wolfsberg

EUROTAP rating: Acceptable

Location:	Austria, near Spittal
	A 10 between Salzburg and Villach
Year opened:	West tube 1973 / east tube 1985
Length:	950m
Portal height level:	657 / 629m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	100kph
Vehicles per day:	21,243
Share of HGVs:	18.4%
Breakdowns / accidents / fires:	3 / 2 / 0
Risk:	Medium

Strengths and weaknesses

- Two tubes with unidirectional traffic
- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of emergency phones and fire extinguishers
- Emergency phones and fire extinguishers provided every 190 to 350 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- Ventilation is powerful enough to deal with a fire
- Rescue service vehicles can cross at the portals
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff
- Regular emergency drills
- Fire brigade is well-trained and well-equipped

- Lighting is too weak
- No loudspeakers

☹ Distance between emergency phones and fire extinguishers is up to 350 metres and hence too long

☹ No additional escape or rescue routes

☹ No automatic fire alarm system

Plans for the future

- Autumn 2008 to 2009: General refurbishment of the tunnel

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the low traffic volume of around 21,300 vehicles per day and unidirectional traffic, and a tunnel length of only around 950 metres. The HGV share of 18.4 percent is relatively high, and there are no restrictions on the transport of hazardous goods.
- The preventive measures must be individually evaluated. Unidirectional traffic, sufficiently wide lanes and video surveillance of the tunnel around the clock by trained staff in the tunnel control centre are positive measures. But poor lighting in the tunnel is a negative finding.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. Motorists are guided, if necessary, using traffic lights and receive information via traffic radio. There is no automatic fire alarm system; this means that in the event of fire, the ventilation is not automatically activated nor is the closing of the tunnel initiated. Good training and equipment for the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- The necessary preconditions for effective self-rescue in the event of fire need to be improved. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone; however, they can only leave the tunnel through the portals. There are no additional emergency exits.

Kalcherkogel EUROTAP rating: Very good

Location:	Austria, near Modriach
	A 2 between Graz and Klagenfurt
Year opened:	1982
Length:	2,013m
Portal height level:	1,026 / 1,055m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	100kph
Vehicles per day:	17,300
Share of HGVs:	22%
Breakdowns / accidents / fires:	15 / 3/ 0
Risk:	Medium

Strengths and weaknesses

- Two tubes with cross-connections as additional escape and rescue routes every 307 to 382 metres
- Traffic lights and variable information displays in front of the portals
- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers
- Lay-bys in the middle of the tunnel
- Sound-insulated emergency phones and fire extinguishers provided every 212 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed
- Ventilation is powerful enough to deal with a fire
- Rescue service vehicles can cross at the portals
- Rescue route for emergency service vehicles leading to neighbouring tube located in the middle of the tunnel
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan

 Regular training for tunnel staff

 Regular emergency drills

 Fire brigade is well-trained and well-equipped

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the low volume of traffic of around 17,300 vehicles per day and unidirectional traffic. However, the HGV share of 22 percent is relatively high, and there are no restrictions on the transport of hazardous goods.
- Unidirectional traffic, sufficiently wide lanes, lay-bys and lighting are the main reasons for the very good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs, as well as by information displays at the portals, traffic radio and via loudspeakers. An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. Good training and equipment for the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone and can leave the tunnel through the clearly marked emergency exits.

Ligerz

EUROTAP rating: Good

Location:	Switzerland, near La Neuveville
	N 5 between La Neuveville and Bienne
Year opened:	1989
Length:	2,510m
Portal height level:	434 / 436m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	80kph
Vehicles per day:	13,100
Share of HGVs:	4.6%
Breakdowns / accidents / fires:	0 / 2 / 0
Risk:	Medium

Strengths and weaknesses

- Traffic radio throughout the tunnel, the operator can broadcast messages
- Video surveillance with cameras around every 250 metres
- Lay-bys on opposite sides every 720 metres
- Sound-insulated emergency phones and fire extinguishers provided every 160 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes; doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed
- Ventilation is powerful enough to deal with a fire
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff

- Lighting is too weak
- No loudspeakers
- Neither traffic, traffic disruptions nor the use of lay-bys are automatically detected
- The distance of 1,250 metres between emergency exits is too long
- No regular emergency drills

Plans for the future

- Revision of the ventilation plan
- A parallel safety gallery with cross-connections every 300 metres is to be built
- Tunnel to be extended to a length of around five kilometres

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the traffic volume of around 13,000 vehicles per day and bi-directional traffic, and a tunnel length of around 2.5 kilometres. Although there are no restrictions on the transport of hazardous goods, hazardous goods are not transported very often.
- The preventive measures must be individually evaluated. Sufficiently wide lanes, lay-bys and surveillance of the tunnel by trained staff in the tunnel control centre, which is manned around the clock, are positive measures. Poor lighting and insufficient detection of traffic disruptions or emergencies are negative findings.
- An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. If necessary, motorists are guided using traffic lights and variable traffic signs along with information provided via traffic radio. Good fire fighting equipment and the supply of fire-fighting water in the tunnel ensure effective fire fighting. At least an emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services.
- The ventilation system extracts the smoke near the seat of the fire out of the tunnel. This means that people can leave the tunnel through an area that is mostly smoke-free. The distance between emergency exits, however, is too long.

Sachseln

EUROTAP rating: Acceptable

Location:	Scwitzerland, near Sachseln A 8 between Lucerne and Berne
Year opened:	1997
Length:	5,190m
Portal height level:	474 / 479m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	80kph
Vehicles per day:	8,377
Share of HGVs:	6.6%
Breakdowns / accidents / fires:	2 / 1 / 0
Risk:	Medium

Strengths and weaknesses

 Traffic radio throughout the tunnel, the operator can broadcast messages (in several languages)

 Full video surveillance

 Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers

 Lay-bys on opposite sides every 700 metres

 Sound-insulated emergency phones and fire extinguishers provided every 150 metres

 Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit

 No smoke or heat can penetrate into external escape routes; doors are sufficiently fire-resistant

 Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed

 Tunnel control centre manned around the clock by trained staff

 Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade

 Up-to-date and complete emergency response plan

 Regular training for tunnel staff

 Regular emergency drills

 Lighting is too weak

 The distance of 2,590 metres between emergency exits is too long

 Ventilation is not powerful enough to cope with a fire, ventilation control is not effective enough

 The maximum time of use for the fire brigade's respiratory equipment is too short

 Knock-out criterion! The test result was lowered from Good to Acceptable due to the very poor result in the Escape and rescue routes and Ventilation categories (refer to Methodology: How we tested).

Plans for the future

- New lighting and new coating on tunnel walls
- A parallel safety gallery with cross-connections every 300 metres is to be built

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the length of the tunnel, i.e. almost 5.2 kilometres, and a HGV share of 6.6 percent. Although there are no restrictions on the transport of hazardous goods, hazardous goods are not transported very often.
- Sufficiently wide lanes and lay-bys are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff. Lighting, however, is too weak.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs along with information provided via traffic radio. An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- The necessary preconditions for effective self-rescue in the event of fire are insufficient. The distance between emergency exits is too long. Moreover, the ventilation system warrants only limited smoke extraction.

Flüelen

EUROTAP rating: Very good

Location:	Switzerland, near Altdorf A 4 between Schwyz and Altdorf
Year opened:	2005
Length:	2,590m
Portal height level:	465 / 437m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	80kph
Vehicles per day:	12,018
Share of HGVs:	5.5%
Breakdowns / accidents / fires:	6 / 0 / 0
Risk:	Medium

Strengths and weaknesses

- Traffic lights and barriers in front of the portals
- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers
- Lay-bys on opposite sides every 650 metres
- Sound-insulated emergency phones and fire extinguishers provided every 150 metres
- Emergency exits provided every 270 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed
- Ventilation is powerful enough to deal with a fire
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff
- Regular emergency drills
- Fire brigade is well-trained and well-equipped

 No loudspeakers

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the traffic volume of around 12,000 vehicles per day and bi-directional traffic, a tunnel length of more than 2.5 kilometres, and the unrestricted transport of hazardous goods.
- Sufficiently wide lanes, lay-bys and lighting are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Any incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs, as well as by information displays at the portals and traffic radio. An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- In the event of fire, there are very good necessary preconditions in place for effective self-rescue. The ventilation system extracts the smoke near the seat of the fire out of the tunnel. This means that people in the tube can use the well-signposted emergency exits to find their way to the safety galleries through a largely smoke-free zone.

San Bernardino EUROTAP rating: Very good

Location:	Switzerland, near San Bernardino A 13 between Splügen and Bellinzona
Year opened:	1967
Length:	6,596m
Portal height level:	1,613 / 1,631m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	80kph
Vehicles per day:	6,548
Share of HGVs:	6.7%
Breakdowns / accidents / fires:	34 / 1 / 1
Risk:	Low

Strengths and weaknesses

- No hazardous goods transported through the tunnel
- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Automatic detection of emergency phone or fire extinguisher use
- Lay-bys provided every 750 metres
- Sound-insulated emergency phones and fire extinguishers provided every 250 metres
- Emergency exits provided at least every 380 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes; doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed
- Ventilation is powerful enough to deal with a fire
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Emergency response plan is complete
- Regular training for tunnel staff
- Regular emergency drills
- Tunnel fire brigade is well-trained and well-equipped

 No loudspeakers

Plans for the future

- End of 2010: Extension of the 50 kV installation

Briefly and to the point

- The low risk found for driving through the tunnel was primarily due to the length of the tunnel, i.e. 6.6 kilometres, a HGV share of 6.7 percent and the long gradients in front of the tunnel.
- Sufficiently wide lanes, lay-bys and lighting are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- At least the use of an emergency phone or fire extinguisher is automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs along with information provided via traffic radio. An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- In the event of fire, there are very good necessary preconditions in place for effective self-rescue. The ventilation system extracts the smoke near the seat of the fire out of the tunnel. This means that people in the tube can use the well-signposted emergency exits to escape to the air duct through a largely smoke-free zone.

Mappo-Morettina EUROTAP rating: Very good

Location:	Switzerland, near Locarno A 13 between Bellinzona and Brissago
Year opened:	1996
Length:	5,530m
Portal height level:	211 / 201m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	80kph
Vehicles per day:	22,259
Share of HGVs:	5%
Breakdowns / accidents / fires:	12 / 8 / 0
Risk:	Medium

Strengths and weaknesses

- No hazardous goods transported through the tunnel
- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers
- Lay-bys provided every 640 metres
- Sound-insulated emergency phones and fire extinguishers provided every 160 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed
- Ventilation is powerful enough to deal with a fire
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff
- Fire brigade is well-trained and well-equipped

- No loudspeakers

☹ The distance of up to 740 metres between emergency exits is too long

☹ No regular emergency drills

Plans for the future

2011:

- Installation of variable information displays at the portals and video surveillance with automatic detection of traffic disruptions
- Installation of new smoke extraction fans

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the traffic volume of around 22,500 vehicles per day and bi-directional traffic, and a tunnel length of around 5.5 kilometres.
- Sufficiently wide lanes, lay-bys and lighting are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs along with information provided via traffic radio. An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. Good training and equipment for the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. At least an emergency response plan co-ordinates co-operation between the tunnels control centre and emergency services. However, regular drills are not carried out.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system extracts the smoke near the seat of the fire out of the tunnel. This means that people in the tube can use the emergency exits and escape through a largely smoke-free environment. However, the distance between emergency exits is too long.

Capistrano

EUROTAP rating: Good

Location:	Spain, near Nerja A 7 between Cadiz and Barcelona
Year opened:	2000
Length:	968m
Portal height level:	133 / 151m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	80kph
Vehicles per day:	16,253
Share of HGVs:	10.3%
Breakdowns / accidents / fires:	8 / 4 / 0
Risk:	Medium

Strengths and weaknesses

- Two tubes with cross-connections as additional escape and rescue routes every 370 metres
- Traffic lights and variable information displays in front of the portals
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of emergency phones and fire extinguishers
- Emergency lanes the full length of the tunnel
- Emergency phones and fire extinguishers provided every 175 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes; doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, ventilation is automatically activated
- Rescue service vehicles can cross at the portals
- Tunnel control centre manned around the clock by trained staff
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff

- Traffic radio cannot be received throughout the tunnel
- Safety-relevant cables are not sufficiently fire-resistant
- The power supply is not protected against power cuts

☹ Radio communications are not possible throughout the tunnel for tunnel staff, police and fire brigade

☹ No regular emergency drills

☹ The maximum time of use for the fire brigade's respiratory equipment is too short

Plans for the future

- Ventilation and power supply are to be improved
- Installation of video surveillance with image analysis and a system for traffic and tunnel radio

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to a HGV share of around 10 percent and the unrestricted transport of hazardous goods.
- Unidirectional traffic, sufficiently wide lanes, emergency lanes and lighting are the main reasons for the very good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs, as well as by information displays at the portals and loudspeakers. An automatic fire alarm system detects fires and activates ventilation. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. At least an emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services. However, regular drills are not carried out.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone and can leave the tunnel through the emergency exits. However, if conditions are unfavourable at the portals, it may be possible for smoke to enter the other tube.

Guadarrama III EUROTAP rating: Very good

Location:	Spain, near Guadarrama AP 6 between Madrid and A Coruña
Year opened:	2007 (only the newest tube was tested)
Length:	3,148m
Portal height level:	1,275 / 1,229m above sea level
Number of tubes:	1 / unidirectional traffic
Speed limit:	100kph
Vehicles per day:	21,995
Share of HGVs:	14.3%
Breakdowns / accidents / fires:	10 / 2 / 0
Risk:	Medium

Strengths and weaknesses

- One tube with unidirectional traffic (the tunnel comprises at total of three tubes with unidirectional traffic, only the newest tube was tested)
- Traffic lights and barriers in front of the portals
- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers
- Lay-bys provided every 750 metres
- Sound-insulated emergency phones and fire extinguishers provided every 125 metres
- Emergency exits provided every 400 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant
- Automatic fire alarm system
- Ventilation is powerful enough to deal with a fire
- Rescue service vehicles can cross at the portals
- Access for rescue vehicles to neighbouring tube every 600 metres
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan

 Regular training for tunnel staff

 Regular emergency drills

 Fire brigade is well-trained and well-equipped

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the traffic volume of around 22,000 vehicles per day with unidirectional traffic, a HGV share of almost 15% and a tunnel length of around 3.1 kilometres.
- Unidirectional traffic, sufficiently wide lanes, lay-bys and lighting are the main reasons for the very good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs, as well as by information displays at the portals, traffic radio and via loudspeakers. An automatic fire alarm system is installed to detect fires. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone and can leave the tunnel through the emergency exits.

Loma de Bas

EUROTAP rating: Very good

Location:	Spain, near Aguilas AP 7 between Cartagena and Vera
Year opened:	2007
Length:	1,797m
Portal height level:	270 / 270m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	80kph
Vehicles per day:	2,760
Share of HGVs:	12.2%
Breakdowns / accidents / fires:	0 / 0 / 0
Risk:	Low

Strengths and weaknesses

- Two tubes with cross-connections as additional escape and rescue routes every 360 metres
- Traffic lights and barriers in front of the portals
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of emergency lanes, emergency phones or fire extinguishers
- Emergency lanes the full length of the tunnel
- Emergency phones and fire extinguishers provided every 125 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, ventilation is automatically activated
- Ventilation is powerful enough to deal with a fire
- Rescue service vehicles can cross at the portals
- Access for rescue vehicles to neighbouring tube every 360 metres
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff
- Fire brigade is well-trained and well-equipped

☹ Traffic radio cannot be received throughout the tunnel

☹ No regular emergency drills

Plans for the future

- Installation of a traffic radio system, also making it possible to broadcast additional messages, and a mobile radio system
- Regular emergency drills

Briefly and to the point

- The low risk found for driving through the tunnel was primarily due to the low traffic volume of 3,000 vehicles per day and unidirectional traffic, and a tunnel length of only 1.8 kilometres. The HGV share of more than 12 percent is relatively high. Although there are no restrictions on the transport of hazardous goods, hazardous goods are not transported very often.
- Unidirectional traffic, sufficiently wide lanes, emergency lanes and lighting are the main reasons for the very good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs, as well as by information displays at the portals and loudspeakers. An automatic fire alarm system detects fires and activates ventilation. Good training and equipment for the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. At least an emergency response plan co-ordinates co-operation between the tunnels control centre and emergency services.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone and can leave the tunnel through the clearly marked emergency exits.

Torrox EUROTAP rating: Good

Location:	Spain, near Torrox A 7 between Cadiz and Barcelona
Year opened:	2002
Length:	1,152m
Portal height level:	159 / 128m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	80kph
Vehicles per day:	16,253
Share of HGVs:	10.3%
Breakdowns / accidents / fires:	8 / 3 / 0
Risk:	Medium

Strengths and weaknesses

☺ Two tubes with cross-connections as additional escape and rescue routes every 410 metres

☺ Traffic lights and variable information displays in front of the portals

☺ Full video surveillance

☺ Automatic detection of traffic disruptions and use of emergency phones

☺ Lay-by in the middle of the east tube and an emergency lane provided along the entire length of the west tube

☺ Emergency phones and fire extinguishers provided every 192 metres

☺ Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit

☺ No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant

☺ Automatic fire alarm system, in the event of fire, ventilation is automatically activated

☺ Ventilation is powerful enough to deal with a fire

☺ Rescue service vehicles can cross at the portals

☺ Access for rescue vehicles to neighbouring tube every 410 metres

☺ Tunnel control centre manned around the clock by trained staff

☺ Up-to-date and complete emergency response plan

☺ Regular training for tunnel staff

☹ Traffic radio cannot be received throughout the tunnel

☹ Safety-relevant cables are not sufficiently fire-resistant

☹ The power supply is not protected against power cuts

☹ Radio communications are not possible throughout the tunnel for tunnel staff, police and fire brigade

☹ No regular emergency drills

☹ The maximum time of use for the fire brigade's respiratory equipment is too short

Plans for the future

- Ventilation and power supply are to be improved
- Installation of state-of-the-art video surveillance with image analysis and a system for traffic and tunnel radio

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to a HGV share of around 10 percent and the unrestricted transport of hazardous goods.
- Unidirectional traffic, sufficiently wide lanes, lay-bys or emergency lanes and lighting are the main reasons for the very good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs, as well as by information displays at the portals and loudspeakers. An automatic fire alarm system detects fires and activates ventilation. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. At least an emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services. However, regular drills are not carried out.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone and can leave the tunnel through the emergency exits. However, if conditions are unfavourable at the portals, it may be possible for smoke to enter the other tube.

Pando

EUROTAP rating: Poor

Location:	Spain, near Pola de Lena AP 66 between Oviedo and León
Year opened:	West tube in 1983/ east tube in 1991
Length:	1,453m
Portal height level:	1,050 / 1,100m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	100kph
Vehicles per day:	11,000
Share of HGVs:	15.9%
Breakdowns / accidents / fires:	95 / 12 / 0
Risk:	Medium

Strengths and weaknesses

 Two tubes with unidirectional traffic

 Traffic lights and barriers in front of the portals

 Full video surveillance

 Lay-bys provided every 130 metres in the one tube and an emergency lane provided the entire length of the other tube

 Automatic detection of traffic disruptions, as well as the use of lay-by/emergency lanes, emergency phones and fire extinguishers

 Emergency phones and fire extinguishers provided every 130 metres

 Automatic fire alarm system with video surveillance, in the event of fire, ventilation is automatically activated

 Rescue service vehicles can cross at the portals

 Tunnel control centre manned around the clock by trained staff

 Radio communications possible throughout the tunnel for tunnel staff and fire brigade

 Up-to-date and complete emergency response plan

 Regular training for tunnel staff

 Lighting is too weak

 Traffic radio cannot be received throughout the tunnel

 No loudspeakers

 No automatic traffic detection

☹ No additional escape or rescue routes

☹ No evacuation lighting for tunnel escape route, no signs showing the escape direction and distance to the portals

☹ Ventilation control in the event of fire is not sufficiently effective

☹ No continuous fire-fighting water supply in the tunnel, no hydrants

☹ Safety-relevant cables are not sufficiently fire-resistant

☹ No emergency power supply

☹ Radio communications for the police are not possible throughout the tunnel

☹ No regular emergency drills

☹ The time it takes the fire brigade to arrive is too long: 35 minutes

Plans for the future

- Lighting is to be improved
- Installation of a traffic radio system, also making it possible to broadcast additional messages, and an uninterruptible power supply
- Installation of additional emergency exits

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the low traffic volume of around 11,000 vehicles per day with unidirectional traffic and a tunnel length of only around 1.5 kilometres. However, the HGV share is almost 16 percent, and there are no restrictions on the transport of hazardous goods.
- Unidirectional traffic, sufficiently wide lanes and lay-bys are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff. Lighting, however, is too weak.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and information is provided by information displays at the portals. Video surveillance can be used to detect fires, ventilation and closing the tunnel must be manually activated. The long time that it takes for the fire brigade to arrive and the lack of fire-fighting water make fire fighting difficult. At least an emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services. However, regular drills are not carried out.
- The necessary preconditions for effective self-rescue in a fire need to be improved badly. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone; however, they can only leave the tunnel through the portals. There are no additional emergency exits.

Eikefet

EUROTAP rating: Very poor

Location:	Norway, near Vikanes
	E 39 between Bergen and Oppedal
Year opened:	1980
Length:	4,910m
Portal height level:	15 / 90m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	80kph
Vehicles per day:	1,970
Share of HGVs:	14%
Breakdowns / accidents / fires:	0 / 0 / 0
Risk:	Low

Strengths and weaknesses

 Lay-bys provided every 1 600 metres

 Emergency phones provided every 500 metres and fire extinguishers every 250 metres

 Escape route signs show the escape direction and distance to the nearest exit

 Tunnel control centre manned around the clock by trained staff

 Up-to-date and complete emergency response plan

 Regular training for tunnel staff

 Lighting is too weak

 Lanes are too narrow: 3 metres wide

 Traffic radio cannot be received throughout the tunnel

 No loudspeakers

 No video surveillance

 No automatic detection of traffic, nor of the use of lay-bys, emergency phones or fire extinguishers

 No emergency lighting

 The distance of 1,600 metres between lay-bys is relatively long, lay-bys are relatively small

 The distance of 500 metres between emergency phones is too long

 No additional escape or rescue routes

 No evacuation lighting to mark escape routes in the tunnel

 No automatic fire alarm system

☹ Ventilation is not powerful enough to cope with a fire, ventilation control is not effective enough

☹ The ventilation section for longitudinal ventilation runs the entire length of the tunnel, i.e. 4,910 metres, and is hence very long

☹ No continuous fire-fighting water supply in the tunnel, no hydrants

☹ Safety-relevant cables are not sufficiently fire-resistant

☹ No system in place to quickly drain flammable and toxic liquids

☹ Radio communications are not possible throughout the tunnel for tunnel staff, police and fire brigade

☹ No regular emergency drills

Plans for the future

By 2017:

- Escape routes to be marked by evacuation lighting
- Installation of video surveillance with automatic detection of traffic disruptions, communication systems and evacuation lighting
- Emergency phones and ventilation to be replaced
- Installation of three more lay-bys

Briefly and to the point

- The low risk found for driving through the tunnel was primarily due to the low volume of traffic of around 2,000 vehicles per day with bi-directional traffic. The tunnel, however, is almost 5 kilometres long and has a HGV share of 14 percent.
- Preventive measures are limited to the presence of trained staff in the tunnel control centre which is manned around the clock. Apart from this, lighting is too weak, the distance between lay-bys is too long and there is no video surveillance.
- Incidents in the tunnel are not automatically reported to the tunnel control centre. Tunnel staff are forced to rely on reports made by motorists using either the emergency phones or their own mobile phones. Due to the lack of video surveillance, the tunnel control centre is unable to gain a complete picture of the situation in the tunnel. Motorists are guided, if necessary, merely by traffic lights at the portals. Fire-fighting is difficult due to the lack of fire-fighting water in the tunnel. At least an emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services.
- The necessary preconditions for effective self-rescue in a fire need to be improved badly. The long ventilation section, which runs the entire length of the tunnel, i.e. 4,910 metres, cannot prevent smoke located a long distance from the seat of the fire from moving downwards from the tunnel ceiling. Moreover, longitudinal flow in the tunnel is not considered in ventilation control. These two aspects can lead to smoke spreading throughout the entire tunnel and this is dangerous in light of the long distance to be covered to the portals.

Jernfjell

EUROTAP rating: Very poor

Location:	Norway, near Matre
	E 39 between Bergen and Oppedal
Year opened:	1989
Length:	2,390m
Portal height level:	57 / 257m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	80kph
Vehicles per day:	1,438
Share of HGVs:	14%
Breakdowns / accidents / fires:	0 / 0 / 0
Risk:	Low

Strengths and weaknesses

 Emergency phones provided every 500 metres and fire extinguishers every 250 metres

 Escape route signs show the escape direction and distance to the nearest exit

 Tunnel control centre manned around the clock by trained staff

 Up-to-date and complete emergency response plan

 Regular training for tunnel staff

 Lighting is too weak

 Lanes are relatively narrow: 2.90 metres wide

 Traffic radio cannot be received throughout the tunnel

 No loudspeakers

 No video surveillance

 No automatic detection of emergency phone or fire extinguisher use

 No emergency lighting

 No lay-bys

 No additional escape or rescue routes

 No evacuation lighting to mark escape routes in the tunnel

 No automatic fire alarm system

 Ventilation is not powerful enough to cope with a fire, ventilation control is not effective enough

 No continuous fire-fighting water supply in the tunnel, no hydrants

☹ No system in place to quickly drain flammable and toxic liquids

☹ The power supply and local power supply are not protected against power cuts

☹ Radio communications are not possible throughout the tunnel for tunnel staff, police and fire brigade

☹ No regular emergency drills

☹ The maximum time of use for the fire brigade's respiratory equipment is too short

Plans for the future

By 2017:

- Escape routes to be marked by evacuation lighting
- Installation of video surveillance with automatic detection of traffic disruptions, communication systems and evacuation lighting
- New emergency phones to be installed
- Two lay-bys to be installed

Briefly and to the point

- The low risk found for driving through the tunnel was primarily due to the low volume of traffic of around 1,500 vehicles per day with bi-directional traffic. The tunnel, however, is 2.4 kilometres long, has a gradient of 8% and a HGV share of 14 percent.
- Preventive measures are limited to the presence of trained staff in the tunnel control centre which is manned around the clock. Apart from this, lanes are relatively narrow and lighting is too weak. There are neither lay-bys nor video surveillance.
- Incidents in the tunnel are not automatically reported to the tunnel control centre. Tunnel staff are forced to rely on reports made by motorists using either the emergency phones or their own mobile phones. Due to the lack of video surveillance, the tunnel control centre is unable to gain a complete picture of the situation in the tunnel. Motorists are guided, if necessary, merely by traffic lights at the portals. Fire-fighting is difficult due to the lack of fire-fighting water in the tunnel. At least an emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services.
- The necessary preconditions for effective self-rescue in a fire need to be improved badly. The ventilation section, which is 2,390 metres long, cannot prevent smoke located a long distance from the seat of the fire from moving downwards from the tunnel ceiling. Moreover, longitudinal flow in the tunnel is not considered in ventilation control. These two aspects can lead to smoke spreading throughout the entire tunnel and this is dangerous in light of the long distance to be covered to the portals.

Matreberg

EUROTAP rating: Very poor

Location:	Norway, near Matre
	E 39 between Bergen and Oppedal
Year opened:	1981
Length:	1,395m
Portal height level:	33 / 110m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	80kph
Vehicles per day:	1,470
Share of HGVs:	14%
Breakdowns / accidents / fires:	0 / 0 / 0
Risk:	Low

Strengths and weaknesses

 Emergency phones provided every 500 metres and fire extinguishers every 250 metres

 Escape route signs show the escape direction and distance to the nearest exit

 Tunnel control centre manned around the clock by trained staff

 Up-to-date and complete emergency response plan

 Regular training for tunnel staff

 Lighting is too weak

 Traffic radio cannot be received throughout the tunnel

 No loudspeakers

 No video surveillance

 No automatic detection of emergency phone or fire extinguisher use

 No emergency lighting

 No lay-bys

 No additional escape or rescue routes

 No evacuation lighting to mark escape routes in the tunnel

 No automatic fire alarm system

 No fire ventilation

 Safety-relevant cables are not sufficiently fire-resistant

 No continuous fire-fighting water supply in the tunnel, no hydrants

☹ No system in place to quickly drain flammable and toxic liquids

☹ The power supply and local power supply are not protected against power cuts

☹ Radio communications are not possible throughout the tunnel for tunnel staff, police and fire brigade

☹ No regular emergency drills

☹ The maximum time of use for the fire brigade's respiratory equipment is too short

Plans for the future

By 2017:

- Escape routes to be marked by evacuation lighting
- Installation of video surveillance with automatic detection of traffic disruptions, ventilation system, communication systems and evacuation lighting
- New emergency phones to be installed
- Installation of a lay-by

Briefly and to the point

- The low risk found for driving through the tunnel was primarily due to the low traffic volume of around 1,500 vehicles per day with bi-directional traffic, and a tunnel length of only 1.4 kilometres. However, the tunnel has a gradient of 8 percent and a HGV share of 14 percent.
- Preventive measures are limited to sufficiently wide lanes and the presence of trained staff in the tunnel control centre which is manned around the clock. Apart from this, lighting is too weak, lay-bys are missing and there is no video surveillance.
- Incidents in the tunnel are not automatically reported to the tunnel control centre. Tunnel staff are forced to rely on reports made by motorists using either the emergency phones or their own mobile phones. Due to the lack of video surveillance, the tunnel control centre is unable to gain a complete picture of the situation in the tunnel. Motorists are guided, if necessary, only by traffic lights at the portals. Fire-fighting is difficult due to the lack of fire-fighting water in the tunnel. At least an emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services.
- The necessary preconditions for effective self-rescue in the event of fire are insufficient. Smoke cannot be precisely extracted from the tunnel. In addition to this, people can only escape through the portals.

Veliki Gložac **EUROTAP rating: Very good**

Location:	Croatia, near Vrbovsko A 6 between Zagreb and Rijeka
Year opened:	North tube in 2004/ south tube in 2007
Length:	1,130m
Portal height level:	494 / 473m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	100kph
Vehicles per day:	10,750
Share of HGVs:	15%
Breakdowns / accidents / fires:	8 / 0 / 0
Risk:	Low

Strengths and weaknesses

- Two tubes with cross-connections as additional escape and rescue routes every 320 metres max.
- Traffic lights and barriers in front of the portals
- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers
- Lay-bys in the middle of the tunnel
- Sound-insulated emergency phones and fire extinguishers provided every 300 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant
- Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed
- Ventilation is powerful enough to deal with a fire
- Rescue service vehicles can cross at the portals
- Rescue route for emergency service vehicles leading to neighbouring tube located in the middle of the tunnel
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan

Regular training for tunnel staff

Regular emergency drills

No loudspeakers

Distance between emergency phones and fire extinguishers is 300 metres and hence relatively long

The maximum time of use for the fire brigade's respiratory equipment is too short

Briefly and to the point

- The low risk found for driving through the tunnel was primarily due to the low traffic volume of around 11,000 vehicles per day with unidirectional traffic and a tunnel length of only 1.1 kilometres. The HGV share, however, is 15 percent.
- Unidirectional traffic, sufficiently wide lanes, lay-bys and lighting are the main reasons for the very good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs along with information provided via traffic radio. An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone and can leave the tunnel through the clearly marked emergency exits.

Waasland

EUROTAP rating: Very poor

Location:	Belgium, in Antwerp
	N 49
Year opened:	1933
Length:	1,769m
Portal height level:	5 / 5m above sea level
Number of tubes:	1/ bi-directional traffic
Speed limit:	50kph
Vehicles per day:	33,000
Share of HGVs:	0%
Breakdowns / accidents / fires:	No data available
Risk:	Medium

Strengths and weaknesses

 No hazardous goods transported through the tunnel

 Traffic lights and barriers in front of the portals

 Traffic radio throughout the tunnel

 Full video surveillance

 Emergency phones provided every 160 metres and fire extinguishers every 40 metres

 Escape route signs show the escape direction and distance to the nearest exit

 Automatic fire alarm system, in the event of fire, ventilation is automatically activated

 Ventilation is powerful enough to deal with a fire

 Tunnel control centre manned around the clock

 Congestion every day

 The operator is unable to broadcast messages on traffic radio

 No loudspeakers

 No automatic detection of traffic, traffic disruptions, nor of emergency phone or fire extinguisher use

 No emergency walkways

 No additional escape or rescue routes

 No evacuation lighting to mark escape routes in the tunnel

 In the event of fire, the tunnel is not automatically closed

☹ No central monitoring of the tunnel (operating equipment supplied by the operator, traffic systems by the police)

☹ Radio communications are not possible throughout the tunnel for tunnel staff, police and fire brigade

☹ No emergency response plan

☹ No regular training for tunnel staff

☹ No regular emergency drills

☹ No information available concerning respiratory protection for the fire brigade

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the ban on both HGVs and the transport of hazardous goods. However, the traffic volume of around 33,000 vehicles per day with bi-directional traffic is high.
- Preventive measures are poor. Daily congestion is the result of too much traffic in the single-tube tunnel. Monitoring is also insufficient. Sufficiently wide lanes and lighting were positively rated.
- Incidents in the tunnel are not automatically reported to the tunnel control centre. Apart from this, traffic lights and variable traffic signs are only located at the portals. Neither traffic radio nor loudspeakers are provided to inform motorists if necessary. At least an automatic fire alarm system detects fires and activates ventilation. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. There is no specific emergency response plan nor are drills conducted regularly, so that co-operation between the tunnel control centre and emergency services is not co-ordinated.
- The necessary preconditions for effective self-rescue in the event of fire need to be improved. The ventilation system extracts smoke near the seat of the fire out of the tunnel, permitting people to go to a mostly smoke-free area, however, this is only possible via the portals which could be quite a long distance away. There are no additional emergency exits. Apart from this, there is no evacuation lighting for the escape route.

Maas

EUROTAP rating: Acceptable

Location:	The Netherlands, in Rotterdam Maas Tunnel
Year opened:	1942
Length:	1,070m
Portal height level:	5 / 6m below sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	50kph
Vehicles per day:	56,000
Share of HGVs:	2.9%
Breakdowns / accidents / fires:	134 / 8 / 0
Risk:	Medium

Strengths and weaknesses

- Two tubes with cross-connections as additional escape and rescue routes every 100 metres
- Traffic lights and variable information displays in front of the portals
- Traffic radio throughout the tunnel
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of emergency phones and fire extinguishers
- Emergency phones and fire extinguishers provided every 60 metres
- Automatic fire detection using video surveillance
- Rescue service vehicles can cross at the portals
- Tunnel control centre manned around the clock by trained staff
- Radio communication possible throughout the tunnel for both the police and the fire brigade
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff

- Congestion every day
- Lanes are relatively narrow: 2.85 metres wide
- The operator is unable to broadcast messages on traffic radio
- No automatic traffic detection
- Emergency phones are not clearly marked

☹ No evacuation lighting for tunnel escape routes, nor signs showing the escape direction and distance to the nearest exit

☹ Smoke and heat can penetrate the external escape routes

☹ Ventilation is not powerful enough to deal with a fire, ventilation control is not effective enough

☹ Radio communication is not possible throughout the tunnel for tunnel personnel

☹ No regular emergency drills

☹ The maximum time of use for the fire brigade's respiratory equipment is too short

Plans for the future

- Escape route signs to show the escape direction and distance to the nearest exit
- Installation of loudspeakers
- New doors for emergency exits
- Improved incident management
- Strategy for emergency drills

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the length of the tunnel, just 1 kilometre, a low HGV share of 2.9 percent and the widely restricted transport of hazardous goods. However, the traffic volume of around 56,000 vehicles per day with unidirectional traffic is high.
- The preventive measures must be individually evaluated. Unidirectional traffic, lighting and video surveillance of the tunnel by trained staff in the tunnel control centre, which is manned around the clock, are positive measures. Relatively narrow lanes and daily congestion due to extremely heavy traffic were negative findings.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights only and are provided with information by information displays at the portals. Video surveillance can be used to detect fires, ventilation and closing the tunnel must be manually activated. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. At least an emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services.
- The necessary preconditions for effective self-rescue in the event of fire need to be improved. Although the ventilation system extracts smoke from the tunnel, the extraction volume is too low. Apart from this, longitudinal flow in the tunnel is not considered in ventilation control. This can lead to smoke spreading throughout the tunnel. But at least during the early phase of a fire, people can leave the tunnel through the emergency exits via a largely smoke-free atmosphere.

Karawanken

EUROTAP rating: Acceptable

Location:	Border tunnel between Slovenia and Austria A 1/ A 11, Jesenice / Slovenia – Villach / Austria
Year opened:	1990
Length:	7,864m
Portal height level:	655 / 621m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	80kph
Vehicles per day:	6,377
Share of HGVs:	17%
Breakdowns / accidents / fires:	15 / 2 / 1
Risk:	Medium

Strengths and weaknesses

 Traffic radio throughout the tunnel, the operator can broadcast messages

 Full video surveillance

 Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers

 Lay-bys provided at least every 1,060 metres

 Sound-insulated emergency phones and fire extinguishers provided every 212 metres

 Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit

 Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed

 Ventilation is powerful enough to deal with a fire

 Tunnel control centre manned around the clock by trained staff

 Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade

 Regular training for tunnel staff

 Regular emergency drills

 Up-to-date and complete emergency response plan

 Fire brigade is well-trained and well-equipped

 Lighting is too weak

 No additional escape or rescue routes

! Knock-out criterion! The test result was lowered from Good to Acceptable due to the very poor result in the Escape and rescue routes category (refer to Methodology: How we tested).

Plans for the future

2008:

- Lighting is to be improved
- Installation of a traffic control system

By 2019:

- Revision of the ventilation strategy in the middle section of the tunnel
- New fire alarm system and new fire-fighting water supply
- Installation of video surveillance with image analysis

In discussion:

- Construction of a safety gallery or a second tube

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the relatively low volume of traffic of around 6,400 vehicles per day with bi-directional traffic. The HGV share of 17% is relatively high and the tunnel is relatively long: 7.9 kilometres. There are no restrictions on the transport of hazardous goods.
- Sufficiently wide lanes and lay-bys are the main reasons for the acceptable rating for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff. Lighting, however, is too weak.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs along with information provided via traffic radio and loudspeakers. An automatic fire alarm system detects fires, activates ventilation, and closes the tunnel. Good training and equipment for the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- The necessary preconditions for effective self-rescue in the event of fire need to be improved. The ventilation system extracts smoke from the tunnel, however, not in the around 1-kilometre long middle section of the tunnel. Effective measures are required here to prevent smoke and heat from spreading. People caught in the zones upstream or downstream from this area can leave the tunnel through a mostly smoke-free zone, however, this means having to go to the portals which may be quite a long distance away. There are no additional emergency exits.

Valsassina

EUROTAP rating: Good

Location:	Italy, near Lecco
	SS 36 between Lecco and Ballabio
Year opened:	2005
Length:	3,300m
Portal height level:	230 / 410m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	70kph
Vehicles per day:	13,000
Share of HGVs:	6%
Breakdowns / accidents / fires:	0 / 0 / 0
Risk:	Medium

Strengths and weaknesses

 No hazardous goods transported through the tunnel

 Traffic lights and variable information displays in front of the portals

 Full video surveillance

 Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers

 Lay-bys provided every 600 metres

 Emergency phones provided every 250 metres and fire extinguishers every 57 metres

 Emergency exits provided every 330 to 450 metres

 Escape route signs show the escape direction and distance to the nearest exit

 No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant

 Automatic fire alarm system

 Ventilation is powerful enough to deal with a fire

 Rescue route for emergency service vehicles located 2,000 metres maximum from one portal

 Tunnel control centre manned around the clock by trained staff

 Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade

 Up-to-date and complete emergency response plan

 Traffic radio cannot be received throughout the tunnel

 No loudspeakers

 No evacuation lighting to mark escape routes in the tunnel

☹ No regular training for tunnel staff

☹ No regular emergency drills

☹ No information available concerning respiratory protection for the fire brigade

Plans for the future

- End of 2008: Installation of a mobile radio system

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the traffic volume of around 13,000 vehicles per day with bi-directional traffic, a HGV share of almost 6 percent, a tunnel length of around 3.3 kilometres and a gradient of 6 percent. Hazardous goods cannot be transported through the tunnel.
- Sufficiently wide lanes, lay-bys and lighting are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs, information is also provided by information displays at the portals. An automatic fire alarm system is installed to detect fires. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. At least an emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system extracts the smoke near the seat of the fire out of the tunnel. This means that people in the tube can use the emergency exits and escape through a largely smoke-free environment.

Marinasco

EUROTAP rating: Very poor

Location:	Italy, near La Spezia NSA 303 between La Spezia and Riccò del Golfo
Year opened:	2007
Length:	2,436m
Portal height level:	200 / 250m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	70kph
Vehicles per day:	2,400
Share of HGVs:	4%
Breakdowns / accidents / fires:	0 / 0 / 0
Risk:	Low

Strengths and weaknesses

 Traffic lights and variable information displays in front of the portals

 Full video surveillance

 Automatic detection of traffic disruptions, as well as the use of lay-bys and fire extinguishers

 Lay-bys provided every 400 metres

 Fire extinguishers provided every 400 metres

 Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated, the tunnel closed and the fire brigade is notified

 Ventilation is powerful enough to deal with a fire

 Traffic radio cannot be received throughout the tunnel

 No loudspeakers

 No emergency phones

 Distance between fire extinguishers of 400 metres is too long

 No additional escape or rescue routes

 No evacuation lighting for tunnel escape routes, nor signs showing the escape direction and distance to the portals

 No tunnel control centre

 Radio communications are not possible throughout the tunnel for tunnel staff, police and fire brigade

 No emergency response plan

 No regular training for tunnel personnel

☹ No regular emergency drills

! Knock-out criterion! The test result was lowered from Poor to Very poor due to the very poor result in the categories of Escape and rescue routes, Incident management and Communication (refer to Methodology: How we tested).

Plans for the future

By the end of 2009:

- Link to the future tunnel control centre in Genoa with activation of automatic image analysis of video surveillance
- Installation of a diesel generator

Briefly and to the point

- The low risk found for driving through the tunnel was primarily due to the low traffic volume of around 2,400 vehicles per day with bi-directional traffic, a low HGV share of 4 percent and a tunnel gradient of 4 percent. Although there are no restrictions on the transport of hazardous goods, hazardous goods are not transported very often.
- Sufficiently wide lanes, lay-bys and lighting are the main reasons for the good result for preventive measures. Although video surveillance is installed, there is currently still no tunnel control centre where the data could be gathered.
- Incidents in the tunnel are currently neither automatically reported nor analysed. If necessary, motorists are guided using traffic lights and variable traffic signs, information is also provided by information displays at the portals. An automatic fire alarm system at least detects fires, activates ventilation, closes the tunnel and notifies the fire brigade. The tunnel has its own supply of fire-fighting water. However, there is no specific emergency response plan nor are drills conducted regularly, so that co-operation between the tunnel control centre and emergency services is not co-ordinated.
- The necessary preconditions for effective self-rescue in the event of fire need to be improved. The ventilation system extracts smoke near the seat of the fire out of the tunnel, permitting people to go to a mostly smoke-free area, however, this is only possible via the portals which could be quite a long distance away. There are no additional emergency exits.

Breva

EUROTAP rating: Very poor

Location:	Italy, near Menaggio SS 340 between Menaggio and Colico
Year opened:	2004
Length:	3,536m
Portal height level:	200 / 200m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	70kph
Vehicles per day:	12,000
Share of HGVs:	6%
Breakdowns / accidents / fires:	2 / 3 / 0
Risk:	Low

Strengths and weaknesses

 Traffic lights and variable information displays in front of the portals

 Lay-bys provided every 500 metres

 Emergency phones provided every 550 metres and fire extinguishers every 70 metres

 Emergency exit provided

 Escape route signs show the escape direction and distance to the nearest exit

 No smoke or heat can penetrate into the external escape route, doors are sufficiently fire-resistant

 Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed

 Tunnel control centre manned around the clock by trained staff

 Congestion every day

 Traffic radio cannot be received throughout the tunnel

 No loudspeakers

 No video surveillance

 No automatic detection of traffic, traffic disruptions, nor of lay-by, emergency phone or fire extinguisher use

 The distance of up to 550 metres between emergency exits is too long

 The distance of up to 2,000 metres between emergency exits is too long

 No evacuation lighting to mark escape routes in the tunnel

 Ventilation is not powerful enough to deal with a fire, ventilation control is not effective enough

☹ Safety-relevant cables are not sufficiently fire-resistant

☹ Radio communications are not possible throughout the tunnel for tunnel staff, police and fire brigade

☹ No emergency response plan

☹ No regular training for tunnel personnel

☹ No regular emergency drills

☹ No information available concerning respiratory protection for the fire brigade

Plans for the future

- 2009: Installation of video surveillance, a traffic radio system and automatic information systems

Briefly and to the point

- The low risk found for driving through the tunnel was primarily due to the traffic volume of around 12,000 vehicles per day with bi-directional traffic, a HGV share of 6 percent, a tunnel length of 3.5 kilometres and a ban on the transport of hazardous goods.
- Sufficiently wide lanes, lay-bys and lighting are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff. However, there is no video surveillance system.
- Incidents in the tunnel are not automatically reported to the tunnel control centre. Tunnel staff are forced to rely on reports made by motorists using either the emergency phones or their own mobile phones. Due to the lack of video surveillance, the tunnel control centre is unable to gain a complete picture of the situation in the tunnel. Motorists are guided, if necessary, only by traffic lights at the portals. An automatic fire alarm system at least detects fires, activates ventilation, and closes the tunnel. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. However, there is no specific emergency response plan nor are drills conducted regularly, so that co-operation between the tunnel control centre and emergency services is not co-ordinated.
- The necessary preconditions for effective self-rescue in the event of fire are insufficient. Although the ventilation system extracts smoke out of the tunnel, it is not possible to contain the spread of smoke. Apart from this, the distance between the only emergency exit and the portals is too long.

Serrone Tondo

EUROTAP rating: Acceptable

Location:	Italy, near Contursi Terme A 3 between Salerno and Reggio Calabria
Year opened:	2007
Length:	1,215m
Portal height level:	90 / 90m above sea level
Number of tubes:	2 / unidirectional traffic
Speed limit:	130kph
Vehicles per day:	45,000
Share of HGVs:	16.1%
Breakdowns / accidents / fires:	0 / 0 / 0
Risk:	Medium

Strengths and weaknesses

 Two tubes with a cross-connections in the middle of the tunnel serving as an additional escape and rescue route

 Traffic lights and variable information displays in front of the portals

 Emergency phones and fire extinguishers provided every 150 metres

 Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit

 No smoke or heat can penetrate into the external escape route, doors are sufficiently fire-resistant

 Automatic fire alarm system, in the event of fire, fire ventilation is automatically activated and the tunnel closed

 Ventilation is powerful enough to deal with a fire

 Rescue service vehicles can cross at the portals

 Rescue route for emergency service vehicles leading to neighbouring tube located in the middle of the tunnel

 Tunnel control centre manned around the clock by trained staff

 Up-to-date and complete emergency response plan

 Regular training for tunnel staff

 Traffic radio cannot be received throughout the tunnel

 No loudspeakers

 No video surveillance

☹ No automatic detection of emergency phone or fire extinguisher use

☹ The distance of up to 640 metres between emergency exits is too long

☹ Radio communications are not possible throughout the tunnel for tunnel staff, police and fire brigade

☹ No regular emergency drills

☹ The time it takes the fire brigade to arrive is too long: 25 minutes

Plans for the future

- 2008: Strategy for annual emergency drills
- 2009: Installation of video surveillance with image analysis and a system for traffic radio

The tunnel was not completed at the time of testing. After completion of the work planned at the end of 2009, the overall rating will be much higher.

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the relatively high traffic volume of around 45,000 vehicles per day with unidirectional traffic, a HGV share of 16 percent and the unrestricted transport of hazardous goods.
- Unidirectional traffic, sufficiently wide lanes, and lighting are the main reasons for the good result for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff. However, there is no video surveillance system.
- At present, incidents in the tunnel are not automatically reported to the tunnel control centre. Tunnel staff are forced to rely on reports made by motorists using either the emergency phones or their own mobile phones. Since there is still no video surveillance, the tunnel control centre is unable to gain a complete picture of the situation in the tunnel. If necessary, motorists are guided using traffic lights and variable traffic signs along with information provided via information displays. An automatic fire alarm system at least detects fires, activates ventilation, and closes the tunnel. The long time which it takes for the fire brigade to arrive makes fire fighting more difficult even though the tunnel has its own supply of fire-fighting water. At least an emergency response plan co-ordinates co-operation between the tunnel control centre and emergency services.
- The necessary preconditions for effective self-rescue in the event of fire need to be improved. The ventilation system draws smoke out of the tube affected in the direction of traffic to a zone where there are usually no people. Anybody downstream from the fire is located in a smoke-free zone and can leave the tunnel through the emergency exits. The distance between emergency exits, however, is too long.

Cernobbio

EUROTAP rating: Very poor

Poorest test result

Location:	Italy, near Cernobbio SS 340 between Cernobbio and Confine di Stato
Year opened:	1983
Length:	2,400m
Portal height level:	202 / 248m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	70kph
Vehicles per day:	18,000
Share of HGVs:	15%
Breakdowns / accidents / fires:	2 / 1 / 0
Risk:	Medium

Strengths and weaknesses

- No hazardous goods transported through the tunnel
- Lay-bys provided every 700 metres
- Emergency exit provided
- Rescue route for emergency service vehicles around 1,800 metres from the portals

- Congestion every day
- Traffic radio cannot be received throughout the tunnel
- No loudspeakers
- No video surveillance
- No automatic detection of traffic, traffic disruptions or emergencies
- No emergency phones
- No fire extinguishers
- Distance from the emergency exit to the portals is around 1,800 metres and hence too long
- No evacuation lighting for tunnel escape routes, nor signs showing the escape direction and distance to the portals
- Smoke and heat can penetrate the external escape routes
- No automatic fire alarm system
- In the event of fire, fire ventilation is not automatically activated and the tunnel is not closed
- Ventilation is not powerful enough to deal with a fire, ventilation control is not effective enough

☹ Safety-relevant cables are not sufficiently fire-resistant

☹ The power supply is not protected against power cuts

☹ No tunnel control centre

☹ Radio communications are not possible throughout the tunnel for tunnel staff, police and fire brigade

☹ No emergency response plan

☹ No regular training for tunnel staff

☹ No regular emergency drills

☹ No information available concerning respiratory protection for the fire brigade

Plans for the future

2010:

- Fire ventilation to be changed to smoke extraction
- Installation of video surveillance, emergency phones, fire extinguishers and an automatic fire alarm system
- Link to the tunnel control centre in Bellano

Briefly and to the point

- The medium risk found for driving through the tunnel was primarily due to the relatively high traffic volume of around 18,000 vehicles per day with bi-directional traffic, a relatively high HGV share of 15% and a tunnel length of around 2.4 kilometres. There is a ban on the transport of hazardous goods.
- Sufficiently wide lanes and lay-bys are the main reasons for the acceptable result for preventive measures. The lighting installed meets with the minimum requirements. However, there is no tunnel control centre and no video surveillance system.
- Incidents in the tunnel are not automatically detected. Tunnel staff are forced to rely on reports made by motorists using mobile phones. Motorists are guided, if necessary, merely by traffic lights at the portals. The tunnel has its own supply of fire-fighting water. However, there is no specific emergency response plan nor are drills conducted regularly, so that co-operation between the tunnel control centre and emergency services is not co-ordinated.
- The necessary preconditions for effective self-rescue in the event of fire are insufficient. The ventilation system can only push smoke out of the tube affected by the fire, however, airflow and control are not sufficient. Because the escape route is also long, it is almost impossible to leave the tunnel through a smoke-free environment. There is no effective smoke extraction or additional emergency exits.

Pont Pla

EUROTAP rating: Very good

Best test result

Location:	Andorra, in Andorra la Vella
	CG 3
Year opened:	2006
Length:	1,260m
Portal height level:	1,026 / 1,070m above sea level
Number of tubes:	1 / bi-directional traffic
Speed limit:	60kph
Vehicles per day:	12,860
Share of HGVs:	0%
Breakdowns / accidents / fires:	60 / 0 / 0
Risk:	Low

Strengths and weaknesses

- No hazardous goods transported through the tunnel
- Traffic lights and barriers in front of the portals
- Traffic radio throughout the tunnel, the operator can broadcast messages
- Full video surveillance
- Automatic detection of traffic disruptions, as well as the use of lay-bys, emergency phones or fire extinguishers
- Lay-bys provided every 310 metres
- Emergency phones provided every 160 metres and fire extinguishers every 45 metres
- Emergency exits provided every 160 metres
- Evacuation lighting for tunnel escape routes, showing the escape direction and distance to the nearest exit
- No smoke or heat can penetrate into external escape routes, doors are sufficiently fire-resistant
- Automatic fire alarm system
- Ventilation is powerful enough to deal with a fire
- Rescue route for emergency service vehicles in the middle of the tunnel
- Tunnel control centre manned around the clock by trained staff
- Radio communications possible throughout the tunnel for tunnel staff, police and fire brigade
- Up-to-date and complete emergency response plan
- Regular training for tunnel staff

 Regular emergency drills

 The maximum time of use for the fire brigade's respiratory equipment is too short

Briefly and to the point

- Despite the maximum gradient of 7 percent, the low risk found for driving through the tunnel was primarily due to the traffic volume of around 13,000 vehicles per day with bi-directional traffic, and a tunnel length of only around 1.3 kilometres. There is also a ban on both HGVs and the transport of hazardous goods.
- Sufficiently wide lanes, lay-bys and lighting are the main reasons for the very good rating for preventive measures. The tunnel is monitored around the clock in a tunnel control centre manned by trained staff.
- Incidents in the tunnel are automatically reported to the tunnel control centre by video link. If necessary, motorists are guided using traffic lights and variable traffic signs, as well as by information displays at the portals, traffic radio and via loudspeakers. An automatic fire alarm system is installed to detect fires. The short distance to be covered by the fire brigade and the supply of fire-fighting water in the tunnel ensure effective fire fighting. An emergency response plan and regular drills ensure good co-operation between the tunnel control centre and the emergency services.
- In the event of fire, there are good necessary preconditions in place for effective self-rescue. The ventilation system ensures stable smoke layering, so that escape to the emergency exits located short distances apart is possible through a mostly smoke-free zone.

METHODOLOGY: HOW WE TESTED

An anniversary for the EuroTAP tunnel test: For the tenth time the test programme was conducted by the motoring clubs and its partner clubs in Europe. In the meantime, it has become the basis and driving force behind EuroTAP (European Tunnel Assessment Programme), the programme for greater tunnel safety in Europe. In the 2008 anniversary year, 31 tunnels were tested in eleven countries: five each in Italy, Switzerland and Spain, four each in Germany and Austria, three in Norway, one each in Andorra, Belgium, Croatia and the Netherlands, as well as the Karawanken tunnel on the border between Slovenia and Austria. The latter tunnel along with the Arlberg and Trebesing tunnels in Austria, the Waasland tunnel in Belgium, the San Bernardino tunnel in Switzerland, the Universität Düsseldorf tunnel and the Wattkopf tunnel in Germany and the Maas tunnel in the Netherlands were re-tested this year. The criteria which determined the choice of test candidates included tunnel length, the importance of the tunnel for holiday traffic and location in the Trans-European road network.

As in previous years, ADAC commissioned DMT GmbH, an international technology services company specialising in raw materials, safety and infrastructure, to carry out the test. The experts from DMT carried out their on-site inspections of the 31 tunnels between 7 January and 1 February 2008. Following inspection of the respective tube, the experts spoke with operators, clarified safety relevant issues and inspected the related documents. Prior to testing, operators were given a data list to record the most important technical tunnel parameters which was checked again on site.

Checklist

A checklist, which is prepared by the traffic experts at ADAC and DMT and revised each year, serves as an objective foundation for testing. This checklist is based on the high standards for road tunnels in Germany, Austria, Switzerland, France and the UK, as well as on the EU Directive on minimum safety standards for tunnels in the Trans-European Transport Network. The checklist is broken down into eight categories: Tunnel system (weighting: 14 percent), Lighting and power supply (7 percent), Traffic and traffic surveillance (17 percent), Communication (11 percent), Escape and rescue routes (14 percent), Fire protection (18 percent), Ventilation (11 percent) and Incident management (8 percent).

Safety and risk potential

The so-called safety potential of a tunnel is rated using the more than 200 criteria of this checklist. It describes all the structural and organisational measures which are designed to prevent emergencies or limit their severity. Apart from this, the so-called risk potential is calculated. This serves as a parameter for the risk of becoming involved in an accident while driving through the respective tunnel and for the seriousness of the consequences which must then be expected. The safety and risk potential are then brought together to reach an overall tunnel rating.

Knock-out criteria

The safety measures in the individual categories can supplement each other or compensate for each other, such as the measures for detecting and managing incidents. However, they can also be more or less independent of each other, as for instance in the area of prevention. The strongest links exist within and between the Escape and rescue routes and Ventilation categories. Serious shortcomings here cannot be subsequently compensated for by other

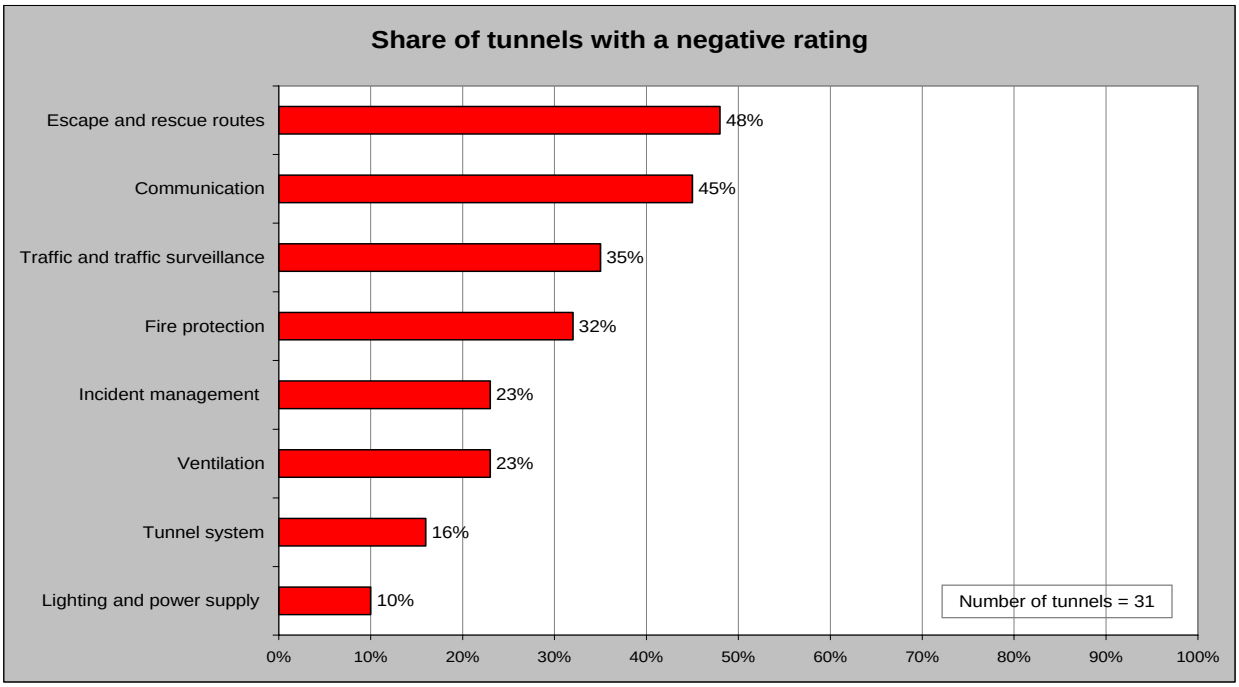
measures. In the tunnel test, this means that if a tunnel is given an positive overall rating, then ideally all eight categories of the safety potential must have a positive result, and at least none of them should be found to be very poor. Otherwise, the so-called knock-out criterion is used to lower the overall rating according to a precisely defined scheme.

On the whole, overall ratings of Very good, Good and Acceptable are in the positive range whilst Poor and Very poor are negative ratings.

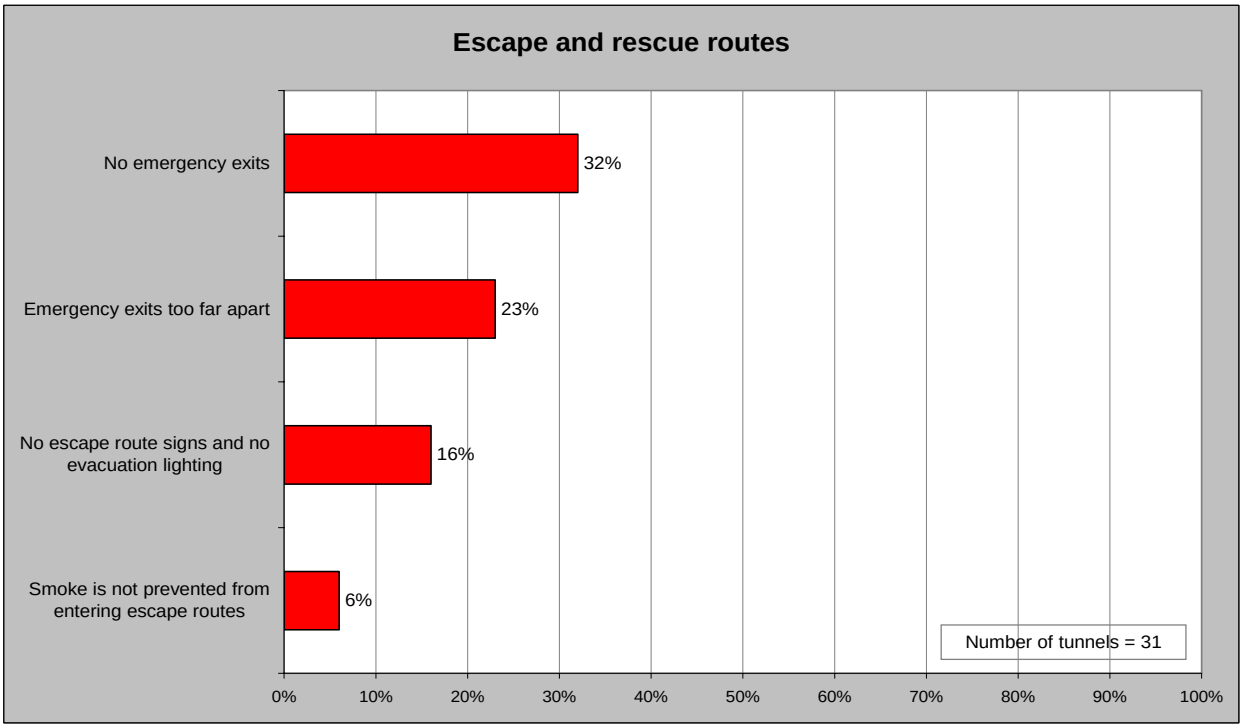
RESULTS: SHORTCOMINGS AT A GLANCE

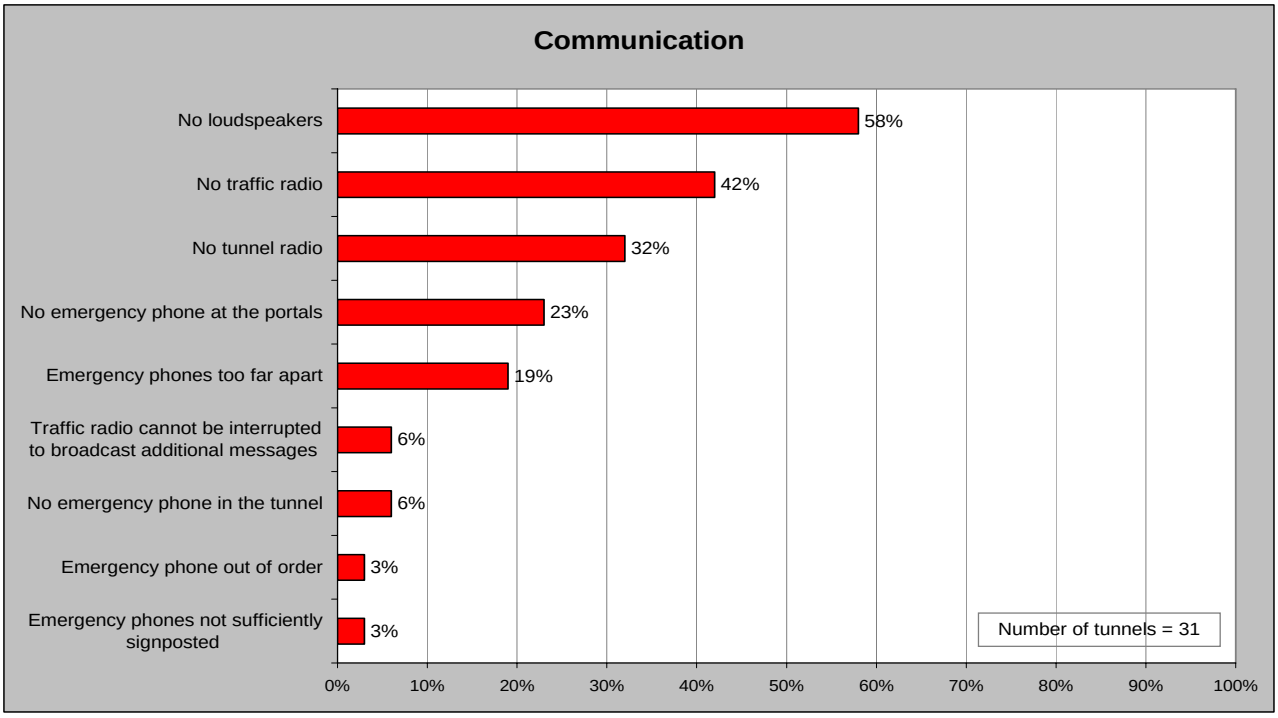
We are pleased to report that the results recorded this year in the categories of Tunnel system and Lighting and power supply were good. But far too many poor results were noted in the categories of Escape and rescue routes and Communication which are so important in an emergency.

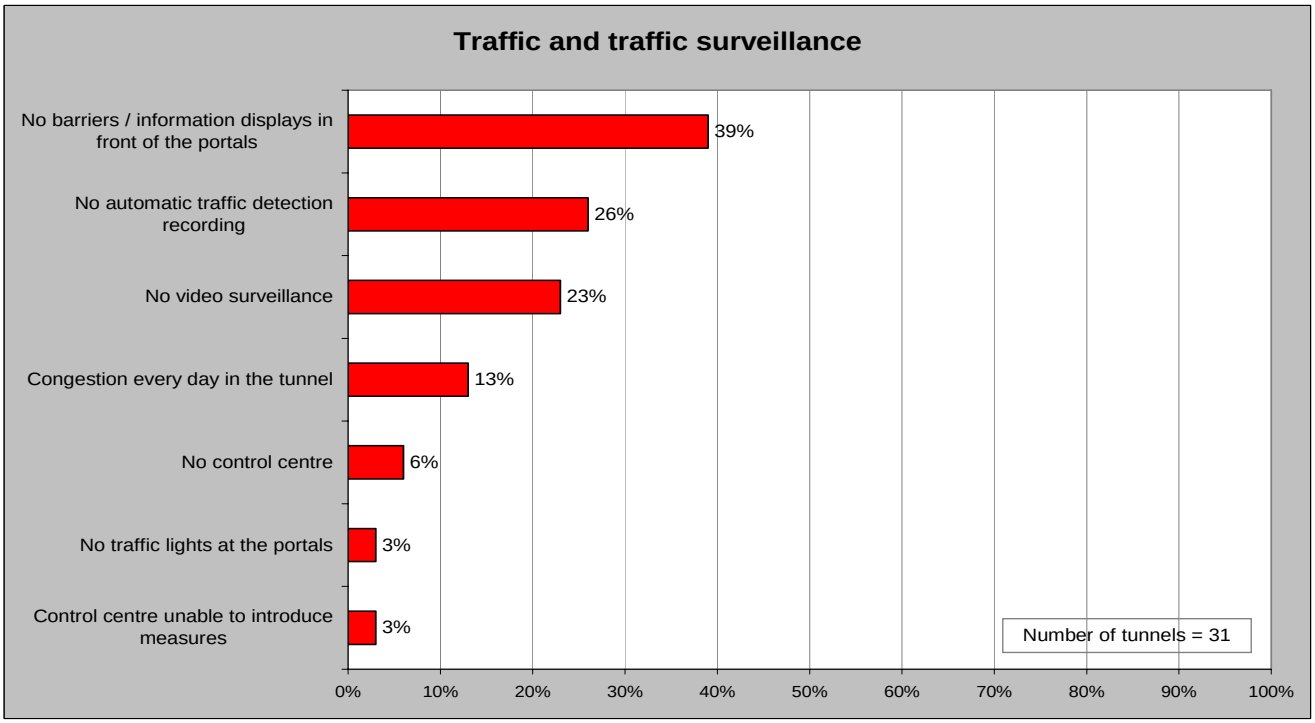
Overview of the categories

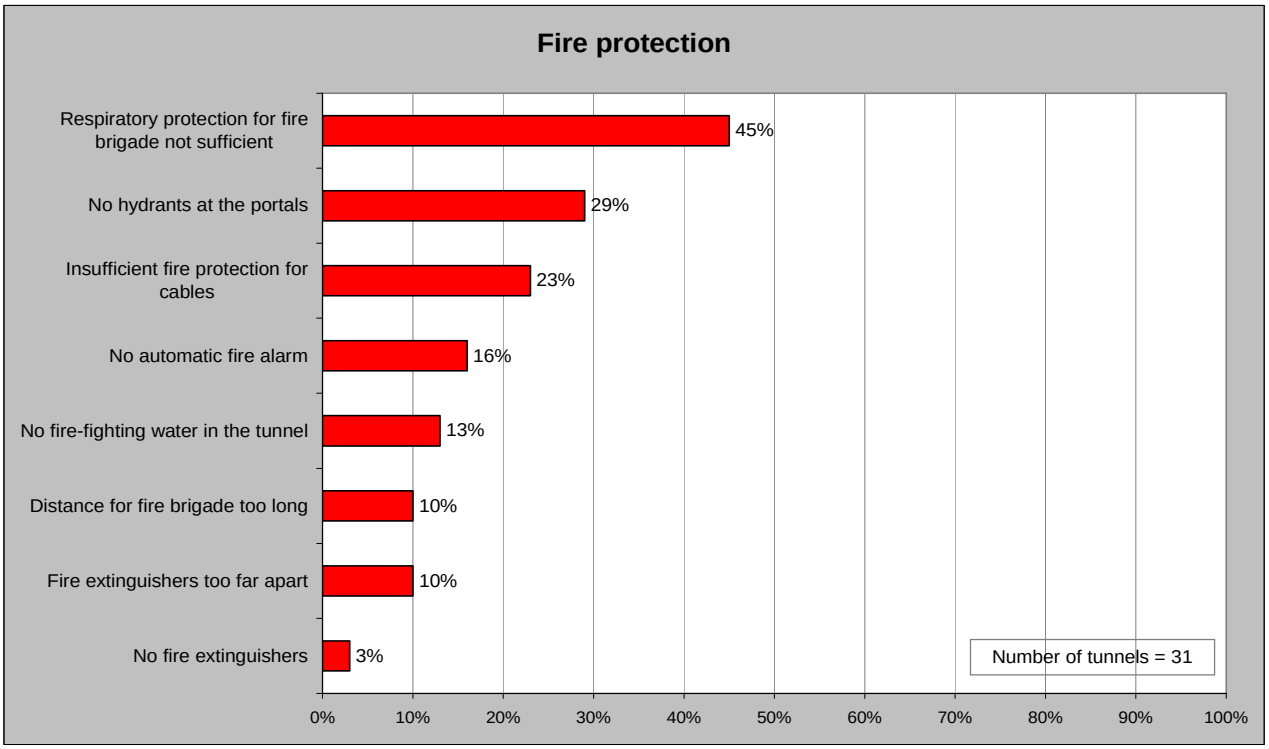


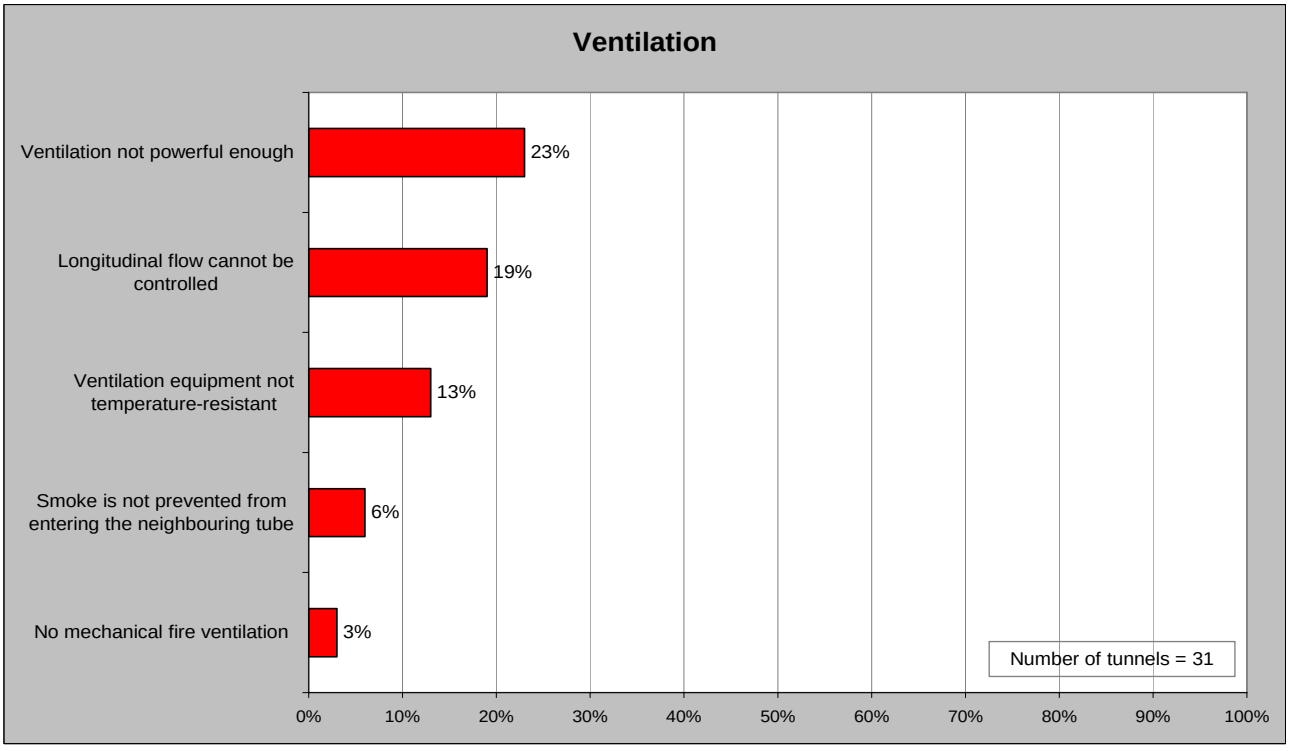
Categories in detail

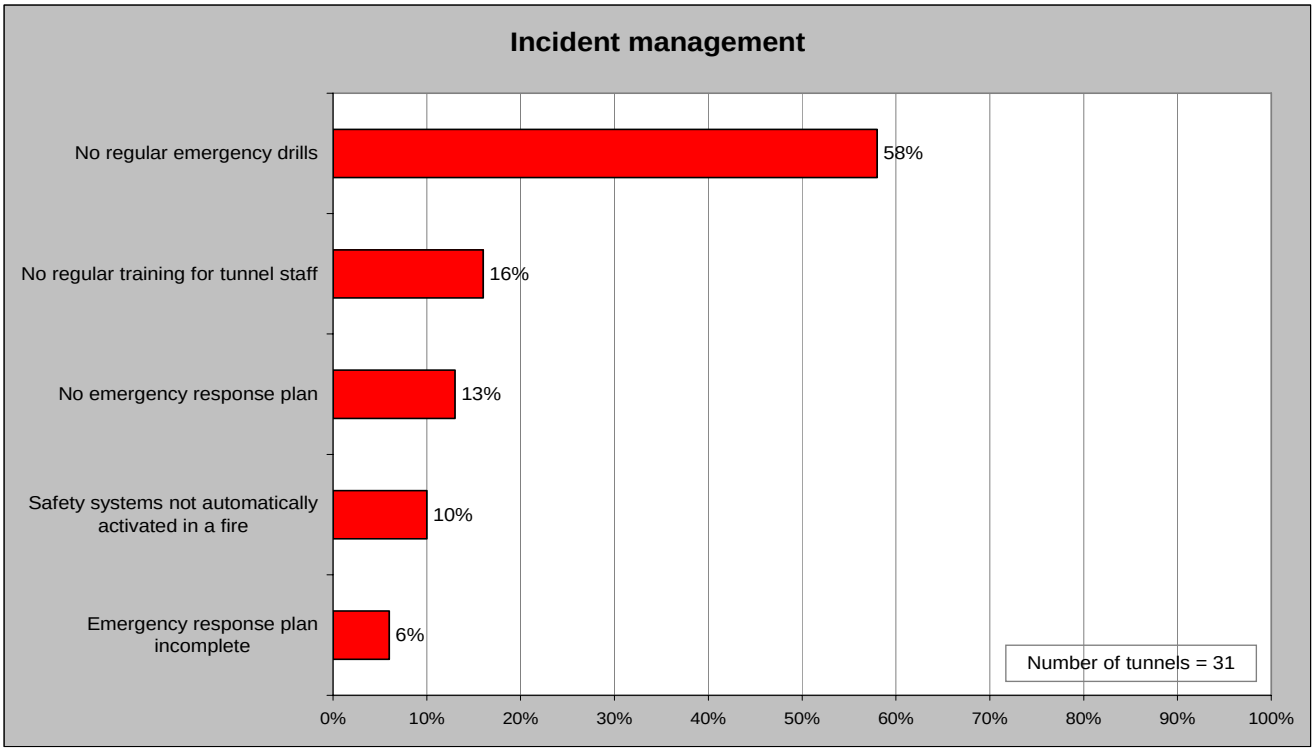


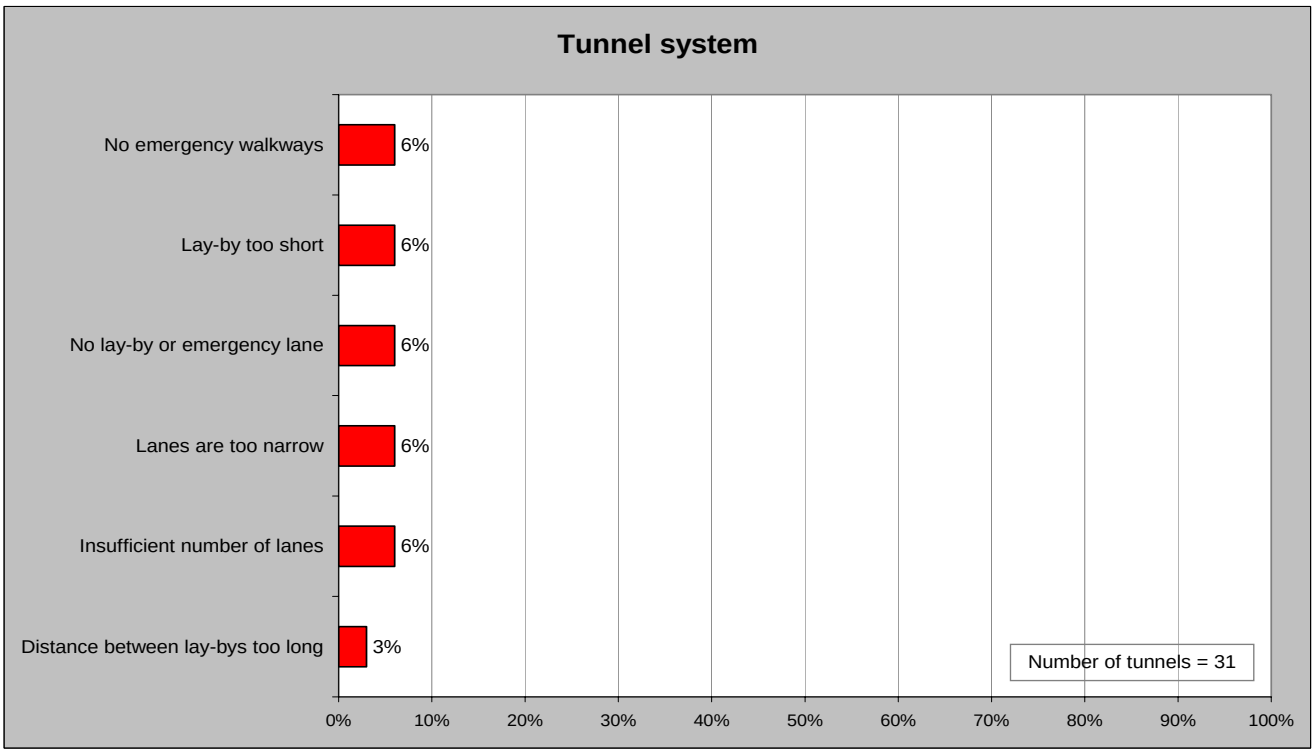


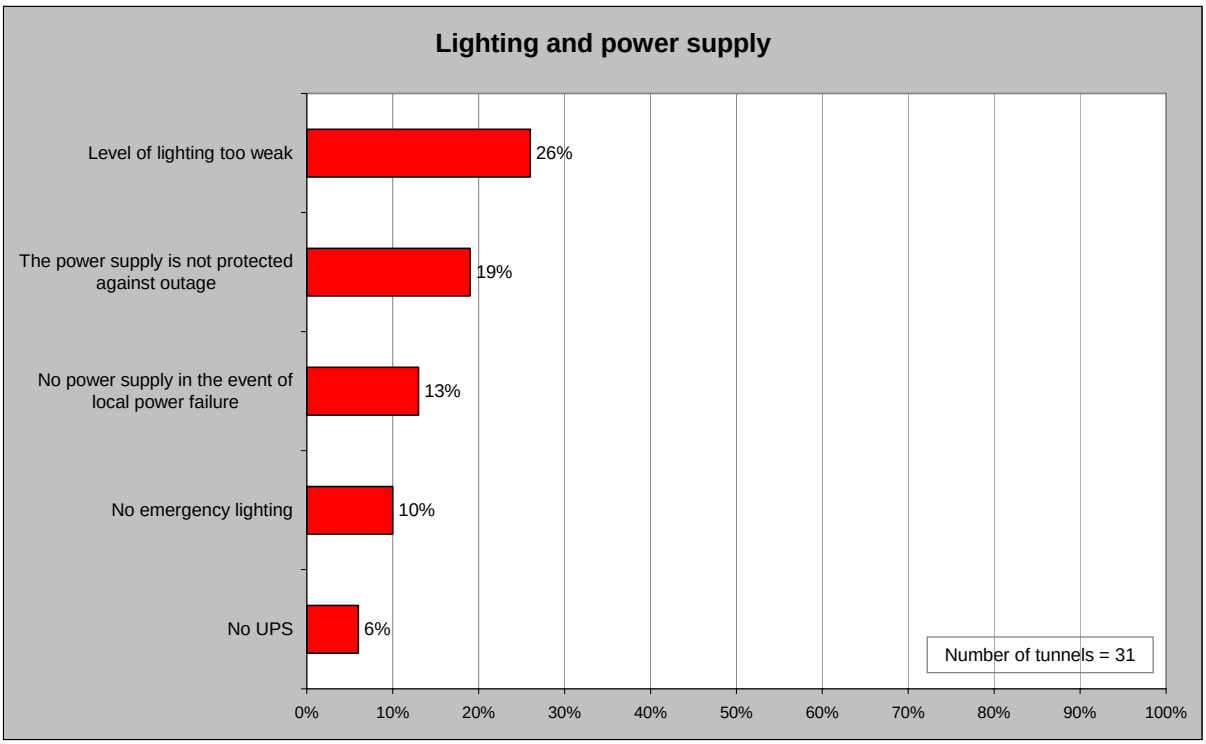












RESULTS: ANALYSIS AND CRITICISM

Anybody who has driven along the SS 340 near Cernobbio on Lake Como will be familiar with the 25-year old Cernobbio tunnel. With its bright walls, good lighting and a few lay-bys, this tunnel makes a fairly good impression. Around 18,000 vehicles roll through this tube every day, however, going in both directions. Although there is a ban on the transport of hazardous goods, the 2,700 HGVs that drive through the tube every day are a factor that must be considered, especially since congestion is an almost everyday occurrence. There is just a single emergency exit over a distance of almost two and a half kilometres. However, it is doubtful whether this exit can be reached in an emergency, because the distance to be covered is long and the escape route is not signposted. Emergency phones are non-existent. There is no video surveillance, no automatic traffic detection, no fire extinguishers and certainly no automatic fire alarm system that could activate ventilation which is inadequate anyway.

Who does what and when in an emergency is simply a matter of luck: a tunnel control centre, an emergency response plan, regular training for staff, emergency drills – nothing doing! With such shortcomings, you could almost overlook the fact that there is no possibility whatsoever to inform motorists if necessary using traffic radio, loudspeakers or variable message displays. Put in a nutshell, Cernobbio tunnel is the very opposite of a safe tunnel. As a result, the brightly lit, apparently welcoming Cernobbio tunnel came last in the 2008 tunnel test. This is the fourth time consecutively that Italy has come last.

The winners

But thankfully enough, shocking shortcomings of this kind were not found very often during this year's inspection of 31 tunnels in eleven European countries. In this, the tenth year of testing tunnels, ten tunnels will be pleased with their rating of “very good” and five with their rating of “Good”. Another seven tunnels made the grade, receiving a rating of “Acceptable”, and hence fulfilled the required minimum standards of the EU Directive on safety in road tunnels.

The honour of winning in this anniversary year went to the around 1.3 kilometre-long Pont Pla tunnel, opened in 2006, in Andorra la Vella, the capital city of the tiny state of Andorra in the eastern Pyrenees between Spain and France. The inspectors found Pont Pla Tunnel, a state-of-the-art, safe tunnel, the very opposite of the losing Italian tunnel. Everything that was criticized in the Italian tunnel was praised in the Pont Pla tunnel.

The losers

The Cernobbio tunnel shares the lowest rating of “very poor” with six other tunnels: the Belgian Waasland tunnel in Antwerp, the Italian Breva tunnel (SS 340 near Menaggio) and, surprisingly, because it is brand new, the Marinasco tunnel (NSA 303 near La Spezia) and the Eikefet, Jernfjell and Matreberg tunnels, all of them in Norway. The Spanish Pando tunnel (AP 66 near Pola de Lena) and the German Universität Düsseldorf tunnel (in Düsseldorf) were rated Poor. The German tunnel would have received a rating of Acceptable had it not received very poor results in the categories of Traffic and traffic surveillance and Communication. This called for the knock-out criterion, thus lowering the overall rating for this tunnel. This means that nine of the 31 tunnels inspected failed to make the grade – a very high number, far higher than in previous test years.

Comparing the countries

Two of the five Italian tunnels tested received positive ratings - a glimmer of hope in light of Italy's customary weak results: the Serrone Tondo tunnel (A 3 near Contursi Terme), opened in 2007, received a rating of Acceptable and the Valsassina tunnel (SS 36 near Lecco) a rating of “good”. However, there was no good news from Norway. All three Norwegian tunnels were rated “very poor”, coming up behind Italy's last place. A round of applause goes to the tunnels in the Alpine countries of Austria and Switzerland: All nine tunnels tested received positive ratings even though the picture was only slightly marred by one rating of Acceptable in each country.

The most important shortcomings

An emergency scenario makes the shortcomings clear. Imagine that a lorry crashes into the tunnel wall and leaking petrol catches fire. Precious minutes pass before you even notice the danger. You want to leave the tunnel. The next emergency exit is 500 metres away. It will take you around eight minutes to reach it. Ten minutes have now passed since the fire broke out. But after ten minutes, heat and smoke have already become critical. The longer the distance to the emergency exit, the longer you will be exposed to smoke and toxic fumes. But in more than half of the tunnels inspected, the distance to the next emergency exit or the portal was more than 500 metres which is the minimum requirement of the EU Directive. Take, for instance, the Karawanken tunnel on the border between Slovenia and Austria with its impressive length of 7,864 metres. You can only leave this tunnel through the portals; there are no additional emergency exits. If you find yourself in the middle of the tunnel, for example, you will have to walk almost four kilometres to reach a portal.

Your escape will be made even more difficult if you have to find your way through dense smoke without any evacuation lighting or without knowing which is the shortest way out of the tunnel. In five of the tunnels inspected, you will be literally forced to grope in the dark.

It now becomes clear just how important ventilation is for your rescue. It should extract as much smoke as possible out of the tube. In more than a quarter of the tunnels, the ventilation systems were not capable of this. This was the case, for instance, in the Sachseln tunnel in Switzerland. This tunnel which is more than five kilometres long, has only one emergency exit in the middle of the tunnel. Or in the Norwegian Matreberg tunnel. No need to worry about ventilation in this tunnel – there is none! Nor are there any additional emergency exits.

In some cases, you may not be able to immediately see the accident. Traffic comes to a halt and nobody knows why. You then have to rely on the information and instructions issued by tunnel staff. In more than half of the tunnels tested, there were no loudspeakers installed. In 42 percent of tunnels, traffic radio cannot be received throughout the tunnel, so that staff cannot use it to pass on information. And for motorists who have not yet entered the tunnel, it's all a big mystery: in 39 percent of the tunnels tested, inspectors found no variable information displays or barriers to clearly request motorists to "Stop".

Meanwhile, rescue measures are underway - quickly and effectively one would hope. You trust that it is so. For things to run smoothly, emergencies must be repeatedly trained. Regular drills with tunnel staff and rescue services, however, are not carried out in more than half of the tunnels. And what's even worse is the fact that in many cases the fire brigade may not have sufficient respiratory protection in order to reach you in the first place. If smoke is dense, this will slow down the fire brigade significantly, so that it could take them half an hour to cover a distance of 300 metres. In more than 45 percent of the fire brigades, respiratory protection does not even last an hour. That's just about enough time to retreat.

Conclusion

The positive trend in recent years came to a sudden stop this year. The results of the 2008 tunnel test were the worst in five years. This may be just a coincidence and due to the choice of tunnels. The fact of the matter, however, is also that there are still many tunnels in Europe which need to be upgraded and refurbished.

For 10 years now, EuroTAP and its partner clubs have been dedicated to improving tunnel safety both in their own countries and internationally. The tunnel tests have generated an awareness of this topic. The fact that a lot has been improved in recent years is certainly thanks to the tireless work of the motoring clubs. And the results of this year's test show that this work will still be needed in the future. EuroTAP will not stop uncovering shortcomings and informing the public of this. EuroTAP will ensure that when it comes to tunnel safety, it is not just the packaging, but also the content which is in order.

EUROTAP: MILESTONES ON THE ROAD TOWARDS SAFER TUNNELS

They were as proud as punch, the operators of the four winning tunnels, recipients of the "European Tunnel Award" presented at the beginning of this year for the first time in the history of tunnel testing. Austria's Ottsdorf tunnel, the Brinje tunnel in Croatia, Spain's M-12 tunnel and the Markusberg tunnel in Luxembourg – the winners from three years of EuroTAP (European Tunnel Assessment Programme). The second highlight of the celebratory event in Brussels was the presentation of a comprehensive EuroTAP Final Report packed with facts and figures on the technical condition of Europe's tunnels. It compiles the experience gained in all the tunnel tests over the past nine years. This marked the end of the first stage of EuroTAP.

EuroTAP, launched at the beginning of 2005 by twelve motoring clubs from eleven countries under the aegis of the FIA and with the financial backing of the European Commission, has planted the issue of European tunnel safety firmly and squarely in the public eye. The three main pillars of the programme are systematic testing of Europe's most important road tunnels plus user friendly information and educational campaigns. The aim is to boost awareness of tunnel safety among those in authority, to achieve transparent tunnel standards and to thus improve these standards along with motorists' behaviour in tunnels.

The fundamentals

Tunnel testing began back in the disastrous year of 1999 when 51 people lost their lives in the horrific blazes in the Montblanc and Tauern tunnels. As luck would have it, just two days after the inferno in the Tauern tunnel, ADAC published the results of the tunnel test conducted throughout Europe, including results for the fatal tunnel. The media response was dramatic. And history took its course. More and more motoring clubs came on board. By 2004, ADAC and its partner clubs had tested around 150 tunnels and published the results across Europe.

Module 1: the tunnel tests

In 2005, the test series became EuroTAP. According to the principle of "testing – assessing – informing – improving", the partner clubs stepped up their campaigns across the board. From 2005 to 2007 alone, EuroTAP inspectors travelled more than 125,000 kilometres, which is equal to three times around the world, testing 152 tunnels in 18 European countries. Their work produced the following findings: 60 percent of Europe's most important road tunnels demonstrated a high level of safety and were rated “good” or “very good”. However, 21 percent of tunnels failed to meet the minimum standards. Put concretely, twelve tunnels were rated “poor” and a further 19 “very poor”. Evidently, the days of tunnels being empty black holes have not yet come to an end. There is still a need for action, especially in older tunnels.

The fact that EuroTAP is successful has been demonstrated time and again. Take the San Juan tunnel in southern Spain, for example: last place in 2002 with a rating of “very poor” and heavily criticised in the media as the worst tunnel in Europe. Spain's government invested around four million euro in order to quickly bring this tunnel up to scratch. Today, this is a state-of-the-art, safe tube. A similar series of events took place in Germany's Kappelberg tunnel near Stuttgart. The harsh criticism expressed in the 2002 test and a rating of “poor” also gave cause for action here. Around 12 million euro went into refurbishing this tunnel.

Module 3: information for motorists

Now let's take a look at the most important element in this safety concept: the motorist. A pan-European information campaign trains motorists in how to behave correctly in tunnels. After all, the human factor is one of the main causes of accidents in tunnels. In order to train motorists, an interactive computer game was developed, the "Safe in the Tunnel" training DVD, as well as a leaflet of the same name, which were distributed to motorists throughout Europe. Motorists can also visit the websites of the clubs and use the "Tunnel Info sheets" to obtain details of all the tunnels tested within the scope of EuroTAP as well as comprehensive information about them.

Module 4: the tunnel database

152 tunnel tests each conducted according to some 200 test criteria; also generate a huge amount of detailed knowledge, contacts, photo and film material. This immense resource of facts and figures has now been systematically archived and packaged in an online database available as a joint platform to all the motoring clubs participating in EuroTAP. This archive is unique in Europe and only marks the beginning; other phases of expansion are due to follow.

The future

The tenth anniversary of the ADAC tunnel test opened up a new chapter for EuroTAP. The FIA (Fédération Internationale de l´Automobile) has taken over from the European Commission which supported the project over the past three years and the circle of partners has increased to 19 motoring clubs in 18 European countries.

Two more key aspects could be added to the activities pursued up to now: training for tunnel staff and for tunnel planners. These people have a decisive role to play in the management of incidents. The results of the most recent tunnel test also underpin the need for action here. With a "EuroTAP Training for Tunnel Staff" e-learning platform, training can be made more varied and cost-efficient by linking theory and practice. A "EuroTAP Tunnel Planner" computer program could also help to harmonise the level of safety. This program could be used by planning engineers to develop plans and by tunnel operators and authorities to check the level of safety in their tunnels.

Europe is on the right track towards improving the level of safety in road tunnels. And EuroTAP has contributed to this. Europe's motoring clubs will continue to pursue this aim with determination, true to their common goal of making all of Europe's tunnels safer by 2019.

GOOD NEWS FOR TUNNELS WITH TWO-WAY TRAFFIC

Let it be said that fewer accidents happen in tunnels with bi-directional traffic than in tunnels with unidirectional traffic – that's according to an Austrian survey. But this study also states that if an accident does happen, this will be more severe than in a tunnel with unidirectional traffic. There is a 48 percent higher chance of dying in an accident in a single-tube tunnel than in a twin-tube tunnel. The severity of the accident results from the risk of a head-on collision. Humans are the weak link and inattention and incorrect action are the most frequent causes of accidents. Or cause of death. After all, in the Viamala tunnel in 2006, nine people died in smoke and fire because they simply could not get away from the scene of the accident in time. The Viamala tunnel, by the way, is only 742 metres long and this shows that even short tunnels have a risk potential that should not be underestimated.

In order to compensate for human error, it is particularly important to ensure high safety standards for tunnels – so that crashes can be avoided in the first place and self-rescue made possible when a disaster occurs. Single-tube tunnels without any escape or rescue routes are certainly critical. This risk increases with every increase in the number of vehicles, the share of HGVs, the length and gradient of the tunnel. The EU Directive from 2004 only requires a second tube for new tunnels with a traffic volume of 10,000 cars or more per day and lane. In the past, a second tube was often not built simply to save costs. This was why refurbishment has been well underway in recent years. At times, step by step: Following the disaster in 1999 in the Montblanc and Tauern tunnels, one of the first immediate measures to be introduced in the Katschberg tunnel was an independent air supply in the emergency phone booths which can hold up to four people. After this, remote-controlled vents were installed to extract smoke. These vents can be opened directly where the seat of the fire is located. This measure was introduced in the Tauern tunnel immediately after the disaster. In April of this year, the second tube of the Katschberg tunnel was completed and the second tube of the neighbouring Tauern tunnel is due to be completed in 2010. But it is not always possible to build another tube, sometimes for political reasons, as is the case with the St. Gotthard tunnel. At least safety galleries were chosen as an alternative. Thanks to the parallel safety gallery in the 17-kilometre long St. Gotthard tunnel, a fire in 2001 which broke out after a head-on collision did not claim even more lives than the eleven lost there.

One feature was very useful for the San Bernardino tunnel. When this tunnel was built, the fresh air duct was installed underneath the lane. And when the tunnel was finally refurbished, this fresh air gallery was transformed into an escape and rescue gallery. A new ventilation system was installed above the traffic lane area. The refurbishment, which took several years, gobbled up around 240 million Swiss francs, that's 80 million more than it cost to built the tunnel itself back in the 1960s.
The situation was completely different in the Arlberg tunnel. Here, cross-connections and a connecting tunnel were built between the 14-kilometre long road tunnel and the 10-kilomtre long rail tunnel that runs parallel to it. By 2014, the rescue route distances are to be shortened even further. The escape routes each contain one assembly room designed to hold several hundred people. The construction costs of this project totalled around 47 million euro.
Up to now, eight million euro have gone into refurbishing the Wattkopf tunnel. After this tunnel was identified by EuroTAP in 2004 as Germany's most dangerous tunnel, funds were immediately approved. Although this tunnel did not give a completely convincing display this year - its rating was lowered due to a lack of emergency exits - a safety gallery is guaranteed for 2010. The ventilation system was generally revamped and this improves the possibilities for self rescue considerably. After all, when a fire breaks out, a smoke-free atmosphere is

justifiable. In this case, demands on ventilation systems are higher in a tunnel with bi-directional traffic where cars are located on both sides of the fire which can additionally hinder access for rescue services. Overpressure must also be maintained in the escape routes of a tunnel system to prevent smoke from entering. A tunnel is a complex system of interaction and each tunnel must be individually adapted to meet the latest applicable safety requirements.

Around one third of the 282 tunnels tested up to now have bi-directional traffic, as do 18 of the 31 tunnels tested this year. Seven of these were given an overall rating of “good” and “very good”, four were rated “acceptable”, and seven “very poor”. It must be said that all of the latter tunnels were found to have serious shortcomings in the categories of “Escape and rescue routes” and “Ventilation”. All in all, over the past ten years, more than twice the number of tunnels with bi-directional traffic were given poorer ratings than tunnels with unidirectional traffic. On the other hand, the Pont Pla tunnel in Andorra, the winner of this year's test, along with some exemplary approaches to accident prevention, “escape and rescue” in other European tunnels and countries, are proof that not every tunnel with just one tube is automatically a dangerous tunnel.

RECOMMENDATIONS: HOW TUNNEL OPERATORS CAN ENSURE SAFETY

Measures to be implemented in the short term:

- Motorists must be given better information: General information on safety and how to behave in tunnels and more specific information on the safety equipment and facilities provided in the tunnel in question (lay-bys, emergency phones, fire extinguishers, emergency exits and similar equipment).
- Orientation in the tunnel should be improved with bright tunnel walls, sufficient lighting and LEDs on the edge of the carriageway.
- When driving through the tunnel, motorists should be instructed to keep a safe distance from other vehicles.
- Motorists should be informed of why the tunnel is closed, for example, using variable traffic signs or variable message signs. Detour routes should be announced on time.
- Escape routes and emergency exits should be clearly marked.
- Hazardous goods should only be transported following registration, and should be escorted, at a sufficiently safe distance or during low-peak times.
- The safety of the tunnel should be checked by independent experts.

To be implemented in the medium to long term within two to ten years:

- Traffic standstills, for instance due to congestion or road works, particularly in tunnels with heavy traffic, should be avoided by suitable means of traffic management.
- Communication must be improved: Traffic radio must be available throughout the tunnel. The feeding of messages into traffic radio should be a standard feature with standardised messages in several languages used for different situations (accident, closure, fire). Loudspeakers should be installed at clearly visible points, e.g. in emergency lanes and cross-connections between neighbouring tubes. Emergency phones should be provided at sufficiently short intervals. Tunnel radio must be warranted for rescue services throughout the tunnel.
- Video surveillance should be improved: Distances between cameras should be reduced; the camera image should be automatically displayed on an alarm monitor; automatic recording and saving of data.
- Ventilation systems must be checked with regard to fire incidents and brought up to today's standard.
- Lay-bys / emergency bays must be provided at short intervals in all tunnels where no emergency lane is provided.
- All tunnels that are longer than 1,000 metres should be equipped with automatic fire alarm systems. Fire detection should be improved, for example, using combined systems (thermal line detectors and visibility impairment equipment installed at certain points or digital video image evaluation).
- Escape routes must be marked, for example, with LEDs, so that they remain visible even when there is smoke in the tunnel.
- Existing escape chambers must be connected to external escape routes.
- Escape and rescue routes must be created: Additional galleries must be built, openings must be made to an existing second tube at short distances, existing supply-air ducts should be converted for use as additional escape routes.
- Fire brigade equipment must be improved and training should take place under realistic conditions (when possible "hot" training in suitable training tunnels).
- Tunnel control centres should be set up and manned by trained staff.

- Safety officers must be put in charge of the following tasks:
  - Regular training for personnel and emergency services
  - Continuously updated, synchronised emergency response plans
  - Regular emergency drills with all the rescue services
  - Evaluation of incidents, accidents and fires
- Tunnels with one tube should be fitted with a second tube

APPENDIX 1

CHRONOLOGY: SERIOUS TUNNEL ACCIDENTS SINCE 1970

18 January 2008 in Austria
In a mass pile-up in the Ofenauer tunnel on the A 10 Tauern motorway, three people were seriously injured and 14 slightly. Three lorries and 15 cars, including a police car, became entangled. According to first information, the accident was caused by extreme ice on the road surface near the tunnel exit.

29 November 2007 in Austria
In the Großliedl tunnel on the south motorway near Bad St. Leonhard, a lorry rammed a car from behind, sending it crashing into the tunnel wall. The 35-year old female driver of the completely demolished car was injured.

3 November 2007 in Belgium
In the Waasland tunnel in Antwerp, two cars collided head-on. Another two cars crashed into the accident site. Two people were seriously injured and one person sustained slight injuries.

12 October 2007 in the US
In a tunnel on Interstate 5, the main link between Los Angeles and San Francisco, in rainy conditions, two lorries collided on the wet surface and triggered a chain reaction. Another 13 lorries crashed into the accident site and caught fire. Flames shot 20 metres out of the portals, explosions were still to be heard hours after the accident took place. The enormous heat caused concrete to melt and fall onto the road, the fire brigade feared that parts of the tunnel would collapse. 20 people were able to escape the burning inferno on foot, ten of them were injured but only slightly.

18 September 2007 in Austria
Motorists had a close shave in a mass pile-up in the Ehrentalerberg tunnel on the A 2 (south motorway) near Klagenfurt involving a total of 14 cars and lorries. This accident was probably triggered when two lorries driving parallel came into contact with each other. Despite the "huge tangle of metal", to quote a witness, nobody was injured.

10 September 2007 in Italy
In the San Martino tunnel on the SS 36 near Lecco, a lorry crashed into the tunnel wall and caught fire. This triggered a mass pile-up. It took rescue services 45 minutes to arrive at the scene of the accident. This was too long. Two people died, ten people were taken to hospital suffering from smoke poisoning.

27 August 2007 in Italy
In the Tarviser Tunnel, a short distance from the border between Austria and Italy, on the Kanaltal motorway, a car skidded and crashed into the tunnel wall. A car coming up behind collided with the first vehicle. The driver of the first car died, her passenger was seriously injured. Both passengers in the other car, a mother and her young daughter, sustained slight injuries.

10 May 2007 in Austria
In the Pfänder Tunnel on the A 14 near Bregenz, a German lorry swerved onto the opposite lane and collided head-on with an articulated lorry from the Czech Republic which then

blocked the traffic lane. A motorbike and another car crashed into the lorry. The motorcyclist and his passenger were seriously injured, the two motorists sustained slight injuries.

23 March 2007 in Australia
A rear-end collision in the 3.5 kilometre long Burnley Tunnel in Melbourne caused a mass pile-up involving three lorries and four cars – and one explosion. At least three people died in the ball of fire, hundreds of motorists were able to escape on foot.

19 January 2007 in Austria
A mass pile-up in the Ehrentalerberg tunnel on the A 2 near Klagenfurt in which 29 cars, nine lorries and a bus collided. Twelve people were injured, none of them some seriously. Around 150 people were able to leave the tunnel safely. It took twelve hours to clear all the vehicles. The accident was caused by single drops of wood pulp or clear varnish which were spread by vehicles driving over them and which transformed the carriageway into a surface that was as slippery as ice.

24 December 2006 in Germany
In the Farchanter Tunnel on the B 2 near Garmisch-Patenkirchen, a women driving a van that had been converted to a mobile home left the carriageway, the vehicle skidded and then turned over. The woman driver suffered fatal injuries. All tunnel users were requested to leave the tunnel immediately because rescue services feared that the bottles of gas in the mobile home might explode.

17 December 2006 in Austria
At the entrance to the Tauern tunnel on the A 10 between Villach and Salzburg, a coach collided with a lorry. The coach carrying 50 passengers turned over. 30 people were injured.

21 November 2006 in Switzerland
In the Crapteig tunnel near Thusis in the Swiss canton of Graubünden, a German articulated lorry carrying wood panels caught fire. The tunnel was shut down immediately, nobody was injured. According to first findings, this accident was caused by technical problems.

9 November 2006 in Germany
In the east tube of Hamburg's Elb tunnel, a bus ran into a lorry and another lorry crashed into the accident site. Eight people were injured.

2 November 2006 in Switzerland
In the Gotthard tunnel on the A 2 between Lucerne and Chiasso, a car veered into the opposite lane and collided with an oncoming lorry. Another two lorries then crashed into the accident site. The motorist died, two HGV drivers were injured.

26 October 2006 in Norway
In the Eidsvoll tunnel near Oslo, a car collided head-on with a tanker. The lorry caught fire immediately. The motorist died in the accident, the lorry injured driver was able to escape.

16 September 2006 in Switzerland
In the Viamala tunnel on the A 13 south of Chur, a car swerved, grazing an oncoming coach carrying an ice hockey team from Tessin. This caused the bus to skid along the tunnel wall and catch fire. Another car crashed into the bus. The two cars also caught fire. The terrible outcome: nine dead and five injured.

25 July 2006 in Austria
A lorry driver from Kassel travelling through the Spering tunnel on the Pyhrn motorway in Upper Austria swerved onto the opposite lane and collided head-on with an oncoming lorry. The driver from Kassel died.

25 December 2005 in Germany
On entering a tunnel on the B 31 near Eriskirch in the Lake Constance district, a car skidded and collided with an oncoming car and the tunnel wall. The vehicle caught fire, four people aged between 18 and 23 burned to death, a fifth victim was hurtled from the vehicle and also died.

20 August 2005 in Switzerland
In the Isla-Bella tunnel on the A 13 between Chur and Bellinzona, two cars grazed each other. One of the cars ended up on the opposite lane where it collided with a bus. One woman died, two people were injured.

17 August 2005 in Austria
In the Roppener tunnel on the Inntal motorway (A 12) in Tirol's Oberland, a minibus drove into a lorry travelling on the opposite lane. The driver died.

6 June 2005 in Germany
In Hamburg's Elb tunnel, a coach carrying more than 40 children crashed into a lorry which had come to a halt due to congestion. Although an empty double-decker bus coming up behind was able to stop in time, a lorry crashed into this bus, pushing the vehicles together. All in all, 24 people were injured, including 20 children.

4 June 2005 in France
In the Fréjus tunnel on the A43/ A32 between Chambéry/ France and Turin/ Italy, a lorry carrying tyres caught fire. The flames spread to three other lorries. Two people died, seven suffered smoke poisoning. The approx 13 kilometre long border tunnel between France and Italy, which was opened in 1980, is one of the most important Alpine axes for heavy duty traffic.

14 April 2004 in Switzerland
300 metres from the exit of the Baregg tunnel on the A 1 between Zurich and Basel, a lorry drove at full speed into the back of a passenger car and two lorries which had come to a halt following a pile-up. The passenger car was completely crushed and caught fire. The fire subsequently spread to one of the lorries. The driver of the car died, five people were injured. A fatal accident had already occurred on Easter Monday in this tunnel: A motorcyclist was hit and run over by a car. Then on 16 April, six vehicles were involved in a pile-up. Thankfully nobody was injured in the collision.

16 August 2003 in Switzerland
An Italian lorry collided head-on with a German car in the Gotthard tunnel. The driver of the car died, the four passengers and the lorry driver were seriously injured. The lorry had veered into oncoming traffic.

7 June 2003 in Turkey
Near Erzincan, a Turkish bus crashed into a tunnel portal. There was no trace of skid marks whatsoever. 27 people died, including the driver.

7 June 2003 in Italy
Near Vicenza, a German coach collided with the crash barrier of a tunnel. Six people, including one child, died, 38 were injured, some seriously.

24 October 2001 in Switzerland
A fire was caused by a head-on collision involving two lorries in the Gotthard tunnel on the A 2 between Göschenen and Airolo. Eleven people lost their lives in this disaster.

17 October 2001 in Denmark
In the Danish Guldborgsund tunnel between Copenhagen and the ferry port of Rödby, a lorry drove into a car in thick fog and caused a mass pile-up. Five people died, nine were injured, some seriously.

31 August 2001 in Austria
Three tunnel accidents in a single day resulted in two dead and nine injured. One women was seriously injured when her car crashed into the portal of the Sonnstein tunnel on the B 145 near Traunkirchen in Upper Austria. In the Lainberg tunnel on the A 9 near Windischgarsten in Austria, two Austrians were killed and two Germans injured in a head-on collision. In the Katschberg tunnel on the A 10 near St. Michael in Lungau, six people were injured in a collision.

26 August 2001 in Switzerland
A head-on collision occurred in the St. Gotthard tunnel on the A 2 between Göschenen and Airolo. A fire broke out in which eleven people lost their lives.

13 August 2001 in Austria
Near Klagenfurt in Kärnten, an Italian coach carrying 30 Polish pilgrims crashed into the portal of the Reigersdorf tunnel. 24 people were injured, some seriously.

8 August 2001 in Austria
In the Amberg tunnel on the Rhine Valley motorway (A 14) between Frastanz and Feldkirch, an Austrian coach and a van, also from Austria, collided. Several approaching vehicles were caught in the subsequent pile-up. Three people died.

6 August 2001 in Austria
In the Gleinalm tunnel on the Pyhrn motorway (A 9) north of Graz, two cars collided head-on. They caught fire immediately. Five people died, including one small child. The four injured people who were rescued included a child who sustained 70 percent burns and two children aged three and five who suffered head injuries and smoke poisoning.

12 April 2001 in Austria
In the Helbersberg tunnel on the Tauern route, a rear-end collision resulted in a mass pile-up. A fire did not break out, but two people died and ten were injured.

11 November 2000 in Austria
At Kitzsteinhorn near Kaprun, a fire broke out in a cable car of a train running through the tunnel to the glacier skiing district. This was caused by a smouldering fire in the heating system. 155 lives were lost, including many children and young people.

29 May 1999 in Austria

A fire broke out in the Tauern tunnel following a rear-end collision. A lorry carrying paint exploded. 24 vehicles subsequently caught fire, turning the tube into a furnace in which 12 people lost their lives. It took 16 hours to get the fire under control.

24 March 1999 in France / Italy
A Belgian lorry carrying flour and margarine caught fire in the Mont Blanc tunnel. A lighted cigarette end caused this fire. The fire quickly spread and was not extinguished until 24 hours later. 39 people died in the fire.

18 November 1996 in the Channel
In the Eurotunnel, a lorry on a freight train caught fire. It took five hours to get the fire under control. Around 30 train passengers suffered serious smoke poisoning.

18 March 1996 in Italy
After a rear-end collision, a tanker exploded in a tunnel near Palermo. 19 cars caught fire. Five people died, 26 people were injured.

10 February 1996 in Japan
On the island of Hokkaido, a huge boulder weighing 50,000 tonnes crashed onto a tunnel tube. It took rescue services several days to reach the accident site. 20 passengers died.

28 October 1995 in Azerbaijan
289 people suffocated and were burned to death in a metro tunnel in Baku. A short-circuit in the electrical equipment of a metro car was suspected to have caused this disaster.

10 April 1995 in Austria
In a mass pile-up in the Pfänder tunnel near Bregenz, four cars caught fire. Three people died. A motorist driving into incoming traffic was the cause of this accident.

3 November 1982 in Afghanistan
In the Salang tunnel north of Kabul, a Soviet army convoy truck collided with a tank lorry. The explosion triggered an inferno. 700 to 2,000 people suffocated and were burned.

7 April 1982 in the US
In the Caldecott Tunnel near Oakland, California, seven people died in a mass pile-up.

11 July 1979 in Japan
In a collision involving several lorries and cars in the Nihonzaka tunnel, seven people lost their lives.

6 November 1972 in Japan
In the 13-kilometre long train tunnel near Fukui, the Kitaguni night express caught fire. This was caused by a fire in the dining car. 29 travellers suffocated.

14 February 1971 in Bosnia
The Zepce-Zenica early train derailed in the tunnel near Vranduk. 34 people suffocated in the subsequent fire.