

Guide to Road Tunnel Safety Documentation

Booklet 5

Emergency Response Plans

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Ministère
des Transports,
de l'Équipement,
du Tourisme
et de la Mer

Guide to Road Tunnel Safety Documentation

For every tunnel in the national road network whose length is over 300 metres, safety documentation is to be compiled and submitted to the prefect. The procedures regarding the documents to be included in this package are subject to regulations.

All persons and services involved in tunnel safety (owners, tunnel operating bodies and emergency services, prefectures) must assist with the compilation of this dossier which, in its final version, will contain, among other things, the essential aspects of tunnel operation under all circumstances.

This **safety documentation guide** is intended for the above services, owners and the relevant consultants.

Issued in March 2003, the introductory document “Safety Documentation Objectives” should be read by anyone who wishes to understand the general intent of the recommended procedures and how the various documents contained in the safety documentation are organised.

The **safety documentation guide**, of which the above-mentioned introductory document may be regarded as “booklet 0”, comprises the following **five booklets**:

- **Booklet 1:** Practical method of compiling safety documentation.
- **Booklet 2:** Tunnels in operation “from the existing condition to the reference condition” (June 2003).
- **Booklet 3:** Risks analyses relating to dangerous goods transport (December 2005).
- **Booklet 4:** Specific Hazard Investigations (September 2003).
- **Booklet 5:** Emergency Response Plans (ERP).

Statutory Background

• Interministerial circular 2000-63 of 25 August 2000 concerning the safety of tunnels in the national road network requires tunnel owners (jointly with tunnel operating bodies in the case of tunnels in operation) to compile safety documentation for all tunnels over 300 metres in length which form a part of the national road network.

• Circular 2000-82 of 30 November 2000 supplementing circular

2000-63 regarding the circulation of vehicles transporting dangerous goods in road tunnels on the national network.

• Decree 2005-701 of 24 June 2005, implementing the law of 3 January 2002 relating to the safety of infrastructures and transport systems which confirms this requirement and extends it to all tunnels over 300 metres in length owned or operated by local authorities.

• Circular 2006-20 of 29 March 2006 implementing this decree.

• Directive 2004/54/EC of the European Parliament and of the Council of 29 April 2004, also confirms this requirement, specifies the responsibilities of stakeholders and defines the minimum requirements applicable to tunnels over 500 metres in length which form a part of the Trans European road network.

Booklet 5

Emergency Response Plans

Introduction

A tunnel's Emergency Response Plan is an essential component of the safety documentation used throughout its life cycle and a key tool for tunnel operation. As such, it deserves particular attention. It aims to define how a tunnel operating body organises its staff and the tasks that are assigned to them in various situations that might affect the safety of people, as well as the methods for alerting outside emergency services and coordinating with them. It takes account of all categories of persons liable to be endangered, including in particular those with reduced mobility or disabilities.

In accordance with the terms of the law on the modernisation of civil security (Law 2004-811 of 13 August 2004), an emergency response plan is one part of the overall organisation of emergency services, extending seamlessly from the tunnel operating body to other services under public authority.

An Emergency Response Plan may be simple or extremely complex depending on the type of equipment in the tunnel and the level of permanent staffing and surveillance

Section A of this booklet sets out definitions and recommendations which apply to all Emergency Response Plans, regardless of their complexity.

Section B provides and explains a template for an Emergency Response Plan. Examples are included to help readers adapt the contents of the Emergency Response Plan to the context of individual tunnels.

A number of diagrams, flowcharts and sheets relating to section A are included in the **appendices**, together with a glossary of specialised terminology.

Section A - Emergency Response Plan objectives and contents

Regulations¹ require an **Emergency Response Plan** to be drawn up by the tunnel operating body in conjunction with the emergency services and prefecture for all tunnels over 300 m in length, be they under construction or in operation.

The term “**emergency services**” encompasses all local services that may intervene in the event of an accident. Such services may be public or private and may or may not be manned by members of the tunnel’s staff. We can therefore distinguish:

- the tunnel operating body’s in-house services, i.e. any patrols and fire-fighters dedicated to the tunnel.
- external services including public emergency services (fire brigade, ambulance, etc.) and law enforcement services (police, *gendarmerie*, *CRS*, etc.).

¹ A reminder of the statutory background is included on the inside front cover.

Section A

Emergency Response Plan objectives

Tunnel operation includes numerous aspects (traffic management, civil engineering maintenance, equipment management, staff supervision and training, administrative tasks, etc.) which all have safety-related effects to a certain extent.

Most operational activities are essentially predictable and can be planned almost entirely (including scheduled interruptions of traffic for inspection, cleaning and maintenance work). These activities are set out in by procedures, instructions, subcontracting agreements, and the like as part of day-to-day operations.

However, certain events or combinations of events are unpredictable and are therefore difficult to control. People's safety can be adversely affected, and the actions to be taken by all parties in such circumstances must therefore be organised in advance.

As stated in the introduction, the aim of an Emergency Response Plan is to define how a tunnel operating body organises its staff and the tasks that are assigned to them in various situations that might affect the safety of people, as well as the methods for alerting outside emergency services and coordinating with them. It takes account of all categories of persons liable to be endangered, including in particular those with reduced mobility or disabilities.

Accordingly, Emergency Response Plans:

- Relate to the safety of people.
- Describe the general principles behind the tunnel operating body's actions and how they interrelate with the procedures of law enforcement and public emergency services in order to respond to situations which might affect the safety of people.

An Emergency Response Plan is the result of **planning** the intervention of all these parties in a way which ensures rapid action and ensures that the tunnel operating body knows exactly what should be done in each situation (see table of participants in section 3.2.).

Conversely, an Emergency Response Plan is not used for planning by outside emergency services as they have their own operational methods.

Section A

Emergency Response Plan contents

An Emergency Response Plan describes in particular:

- The chain of command for the tunnel operating body's resources and how they are coordinated, distinguishing between different levels of responsibility.
- Internal and external monitoring and alert methods (instructions, transmission methods, event definition code, etc.).
- Cases where the non-availability of equipment or operating personnel require the tunnel to be closed to traffic because the safety of people would not be guaranteed satisfactorily.
- Events relating to traffic or the tunnel's immediate surroundings which require the tunnel to be closed to traffic.
- The general principles behind the tunnel operating body's actions and how they interrelate with the procedures of law enforcement and public emergency services in different situations.
- The type of resources to be deployed in different situations, taking into account requirements stemming from the intervention of external services.
- Steps to be taken in terms of traffic management in the tunnel and on access and escape routes.
- Logging methods designed to keep traces of events, decisions and actions taken during a tunnel's operation.

An Emergency Response Plan is one of the basic documents relating to tunnel operation. It forms a part of the safety documentation and is interrelated with other complementary documents, as follows:

- The description of the tunnel and its access routes.
- The description of the organisation, human and material resources and measures planned by the owner of the tunnel to ensure safe operation and maintenance².
- A description of the method for recording and analysing significant incidents and accidents.
- A list of significant past incidents and accidents, with an analysis thereof and details of the lessons learnt.
- A list of safety exercises held and details of the lessons learnt.

The Emergency Response Plan should not repeat the content of these documents.

² As stipulated in section 4.3., the "detailed instructions laid down by the tunnel owner for its safe operation and maintenance" are set out in an operational document which is separate from the Emergency Response Plan (the Instruction Book) and is not a part of the safety documentation.

Section A

Emergency Response Plan scope

3.1. Persons whose safety might be affected

The Emergency Response Plan covers events liable to affect the safety of people.

The main category of persons concerned is of course **tunnel users**. Special consideration must be made for persons with reduced mobility. The plan also relates to personnel working for the tunnel operating body or contractors and who may be present in the tunnel or its technical facilities.

In exceptional cases the plan may also relate to **persons located outside the tunnel but liable to be affected by a major event**, such as in the following cases:

- Accidents involving dangerous goods and resulting in the release of toxic gases which may endanger the neighbouring population.
- If the tunnel structure supports roadways or other spaces accessible to the public.

Likewise, if the **internal or external emergency services** are required to use supported roadways and if specific conditions apply as a result, details must be set out in the Emergency Response Plan.

3.2. Participants

Within the scope of the Emergency Response Plan, participants are those who may intervene in the event that people are endangered. Such participants may work for the tunnel operating body or outside parties.

Tunnel operating body	Outside parties
<ul style="list-style-type: none"> • Tunnel operator • Duty manager • In-house intervention services <ul style="list-style-type: none"> – Patrols – Dedicated fire-fighters • Maintenance services 	<ul style="list-style-type: none"> • Prefecture • Services responsible for managing the route on which the tunnel is located and other road networks • External control centres (<i>CRICR</i>, <i>CNR</i>, etc.) • External intervention services <ul style="list-style-type: none"> – Law enforcement (police, <i>gendarmerie</i>, <i>CRS</i>, etc.) – Public emergency services (fire brigade, civil defence organisations, ambulance services, etc.). • Other parties (roadside assistance services, subcontractors)

Note: In the remainder of this document the term fire-fighters is used to describe both dedicated fire-fighters as well as the public fire brigade.

3.3. Responsibilities in the event of an incident

In circumstances where people's safety may be affected, the tunnel operating body is responsible for taking the appropriate measures to organise actions and interventions. It bears full responsibility for all incidents in which the police or emergency services are not called. When they are called, the tunnel operating body remains responsible until the first external service arrives on site. It is therefore important that the Emergency Response Plan clearly identifies the main events which fall into these two cases.

In accordance with the stipulations of the law on the modernisation of civil security, the chain of command for emergency operations applies as soon as the public fire and rescue services are called (depending on the region of France this may be the *SDIS (Services Départementaux d'Incendie et de Secours)*, the *Brigade des Sapeurs Pompiers de Paris* or the *Bataillon des Marins Pompiers de Marseille*).

This is the case in the event of serious or minor accidents, including fires, that result in material damage and injury or death, for which the tunnel operator is required to call the outside emergency services (fire brigade, police or *gendarmerie*). As the role

of the fire brigade is to rescue victims, it naturally takes command of rescue operations. In this case the rescue operations commander (COS, *Commandant des Opérations de Secours*) acts under the authority of the rescue operations director (DOS, *Directeur des Opérations de Secours*) who is not necessarily present on site. Depending on the severity of the incident and its implications (e.g. whether or not the tunnel is closed), the role of DOS may be assumed either by the mayor or the prefect. If the police and/or *gendarmerie* are first to arrive on site, they take command of rescue operations then transfer command to the fire brigade once it arrives. The tunnel operating body is required to inform the COS of actions already taken and contribute its knowledge of the tunnel to help optimise rescue operations.

If the police and/or *gendarmerie* are called out to an accident resulting in material damage but with no victims, they take command of traffic management as soon as they arrive on site.

3.4. Events to be taken into account

As stated above, an **Emergency Response Plan only covers situations which are liable to affect people's safety**. These situations often arise when a series of varied events occurs under extremely variable conditions, starting from normal tunnel operation. To define these “at risk” situations, it is therefore essential to consider them in relation to “ordinary” situations. Accordingly this guide refers several times to ordinary operating situations even though these are not covered under the Emergency Response Plan.

Two types of event must be considered, as shown in figure 1 (page 10):

- On the x-axis, events stemming from traffic or the tunnel environment.
- On the y-axis, events stemming from tunnel equipment or the human resources responsible for its operation.

In the majority of cases an event occurs on one axis or the other though it is possible for the two types of event to arise at the same time. The diagram shows three main zones, corresponding to actions of varying degrees to be taken by the tunnel operating body depending on the scale and cause of the incident:

- The green zone, closest to the origin, corresponds to the most common situation, i.e. usual operation.
- The orange zone, in which the tunnel operating body takes remedial measures (potentially including traffic restrictions) to cope with a major event.
- The red zone, in which the only possible response is to close the tunnel.

During normal operation, minor events may affect traffic without significantly affecting its flow. Likewise, minor equipment malfunctions may occur. These minor events or malfunctions (within the green zone in figure 1 below) are dealt with by simple interventions organised and carried out often and without difficulty by the tunnel operating body or its usual subcontractors. The details of these ordinary opera-

tions do not fall within the scope of an Emergency Response Plan, which only covers the orange and red zones.

Tunnel operation may be disrupted by a more serious event stemming from traffic, the environment of the tunnel itself or the unavailability of equipment and/or human resources.

Two severity thresholds are defined, the first corresponding to the boundary between the green and orange zones and the second to the boundary between the orange and red zones:

- **Beyond the first threshold**, events related to traffic, the tunnel environment or malfunctions in the tunnel (in the orange zone in figure 1) have significant **consequences** on traffic flow or tunnel operation. They require the tunnel operating body and/or the police to take remedial measures appropriate for the situation encountered. Road traffic is affected but the safety of tunnel users is upheld. The tunnel operates in **degraded mode**.
- **Beyond the second threshold**, events or malfunctions (in the red zone of the figure below) are **critical** and **require the tunnel to be closed**.

Two types of circumstances may result in the second threshold being exceeded:

- **Events affecting traffic:**
These categories of events (typically major accidents or fires) must be listed in the Emergency Response Plan. Given that such events place tunnel users in serious and immediate danger, the tunnel must always be closed forthwith. For tunnels operated at staffing and surveillance level³ D1, the first party to arrive on site closes the tunnel; for tunnels operated at level D2 the duty staff are generally responsible for closing; for tunnels operated at staffing and surveillance level D3 (in working hours) or D4, closure is initiated by the tunnel operator at the control centre.
- **Situations involving severely malfunctioning equipment or a critical shortage of human resources:**
In these situations, the minimal operating requirements (see section 3.5.) are no longer met and the tunnel must be closed. An example would be a major malfunction of the smoke extraction system that would render it unable to evacuate smoke effectively if a fire were to occur.

³ See section 5.1 of Annex II to Circular 2000-63.

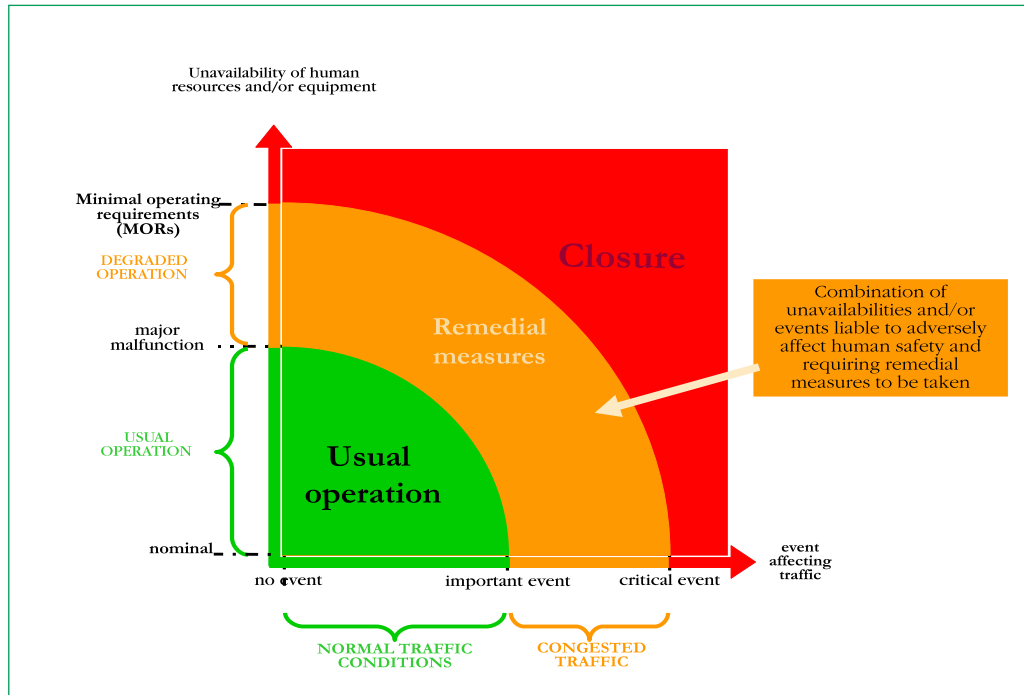


Figure 1: various operating situations

Appendix B provides a typical list (non-exhaustive) of events to be taken into account in an Emergency Response Plan.

3.5. Degraded operating modes and minimal operating requirements

Degraded operating modes and minimal operating requirements are defined relative to nominal conditions, i.e. the tunnel operating conditions when 100% of the operating resources (personnel and equipment) are available.

Degraded operating modes correspond to the operating situations identified in the orange zone in figure 1. It may be useful to define a scale of degraded modes within this zone, with a corresponding scale of remedial measures to be applied. If a degraded operating mode reaches the critical threshold at the boundary between the orange and red zones, this corresponds exactly to a minimal operating requirement (MOR) level below which no remedial measures are sufficient to guarantee the safety of persons in the tunnel. The MOR is thus equal to the minimum availability and performance level of safety equipment and human resources below which the tunnel must be closed to traffic.

Determining degraded operating modes and MOR levels boils down to defining the acceptable operating limits for the resources at the tunnel operating body's disposal, i.e. the human resources and the various equipment categories or combinations of equipment categories. The minimum conditions are tightly linked to the requirements defined in the Technical Instruction of 25 August 2000 and depend on the characteristics of the safety devices in place and the remedial measures liable to be imple-

mented. However, for certain equipment categories the minimum requirements may be identical to the nominal conditions.

To make defining degraded operating modes and MORs simpler, safety equipment can be split into two classes:

- The first corresponds to equipment for which malfunctions and the resulting unavailability cannot be compensated by using other technical means. This class includes power supplies, ventilation systems, emergency exit pressurisation systems, tunnel management systems, etc. These equipment categories are generally designed with appropriate redundancy levels or backup devices in order to extend their operating limits.
- The second class corresponds to equipment for which malfunctions or unavailability may be temporarily compensated by other types of equipment or by remedial operating measures. It includes user information systems (radio broadcasting equipment, lane usage signals and variable message panels), detection systems (emergency telephones, video surveillance cameras, automatic incident detection systems) and pollution sensors (opacimeters, CO sensors, NO sensors).

Loss of performance must be quantified for each equipment category. Simply stating “partial loss” without any quantification is ambiguous and can be an impediment to decision-making.

Degraded operating modes and MORs may be defined to include a time limit; if the limit is exceeded for a MOR, continued unavailability of the equipment concerned will result in the tunnel being closed. The aim of the time limit is generally to allow the tunnel operating body (or its maintenance department) time to repair the defective system. It should be varied as appropriate for the functions of each item of equipment and depending on the tunnel operating body’s ability to maintain the specified remedial measures over time.

To summarise, defining a degraded operating mode or a MOR involves:

- **Material aspects** (qualification and quantification of acceptable loss of function for an equipment category), specifying the location of the equipment where applicable (to avoid cases where a number of adjacent systems are lost).
- **Remedial measures** liable to be taken, such as the use of alternative equipment, human resources (initial response team, patrols, various on-call technicians, etc.) or traffic restrictions.
- The **time limit** after which the degraded mode or MOR is no longer acceptable.

A minimal operating requirement defined in this way is therefore the threshold below which the tunnel must be closed (as soon as any of the above three criteria are no longer met). It is worth noting that the MORs for each tunnel must be defined taking account of the capacity of the equipment deployed in the tunnel and the conditions under which it is operated.

A table of degraded operating modes for equipment (and human resources if applicable) should be drawn up and should specify the “nominal”, “degraded” and “MOR” conditions, together with the measures to be taken by the tunnel operating body in each situation. Progressive maintenance levels, setting out appropriate maintenance actions depending on the extent of the degraded condition and defined in the maintenance plan, can provide a useful reference in defining these measures. Three examples of equipment operating provisions and organisational measures are given below. An Emergency Response Plan must naturally include these provisions for all the equipment and resources available in the tunnel.

If the tunnel is closed due to the minimal operating requirements not being met, it may be reopened as soon as the availability of the defective equipment or personnel is sufficient to achieve a satisfactory safety level, i.e. in nominal mode or in a degraded mode that complies with the MORs.

In certain cases, where tunnel equipment is exceptionally degraded and taking account of the local traffic flow, the tunnel may be reopened subject to specific, temporary operating measures determined with the approval of the relevant administrative authority and, where necessary, on the advice of experts (see section 5.3.2.).

The table below can be taken as an outline for laying down the details of the operating methods.

For an equipment category		
Condition	Definition of condition	Measures to be taken
Nominal	x items of equipment operating	N/A
Degraded 1	Quantitative unavailability: n of x items of equipment Remedial measure: specify where applicable Maximum acceptable duration: specify if necessary	Expedited or emergency maintenance as appropriate
Degraded 2 (if applicable)	Quantitative unavailability: (n + m) of x items of equipment Remedial measure: specify where applicable Maximum acceptable duration: specify if necessary	Expedited or emergency maintenance as appropriate
MOR	Quantitative unavailability threshold: (n + m + p) of x items of equipment Remedial measure: traffic / equipment / human resources Maximum acceptable duration: to be defined	Emergency maintenance. If necessary, inform external intervention services.

Various examples of tables setting out degraded operating modes are given in appendix C.

Section A

The tunnel operating body's actions

4.1. Consistency of the tunnel operating body's actions

The content of an Emergency Response Plan is directly linked to the range of actions available to the tunnel operating body, and thus to the tunnel equipment and operation resources.

In the event of an incident, the tunnel operator performs a number of emergency response actions, either simultaneously or successively, based on the information reported and the means of action at his/her disposal:

- Initiate direct actions on equipment: display messages on variable message panels, close gates, broadcast pre-recorded radio messages, adjust the lighting or ventilation, activate signs.
- Call out internal intervention services.
- Call the police, public emergency services, prefecture or other external parties.

In tunnels with limited equipment and resources, there are very few potential actions that can be taken. In tunnels with sophisticated equipment and significant operational resources, the actions are generally grouped into automated sequences, predefined in the tunnel management system.

The actions to be taken in response to an event are described on two levels:

- General principles of action in the **Emergency Response Plan**.
- Operational details of the provisions in the **Instruction Book**.

This is an important distinction as in practice there is often a degree of confusion regarding these two documents. The Emergency Response Plan sets out the principles of reactions to major incidents; the Instruction Book goes into much more detail and also discusses everyday operating situations.

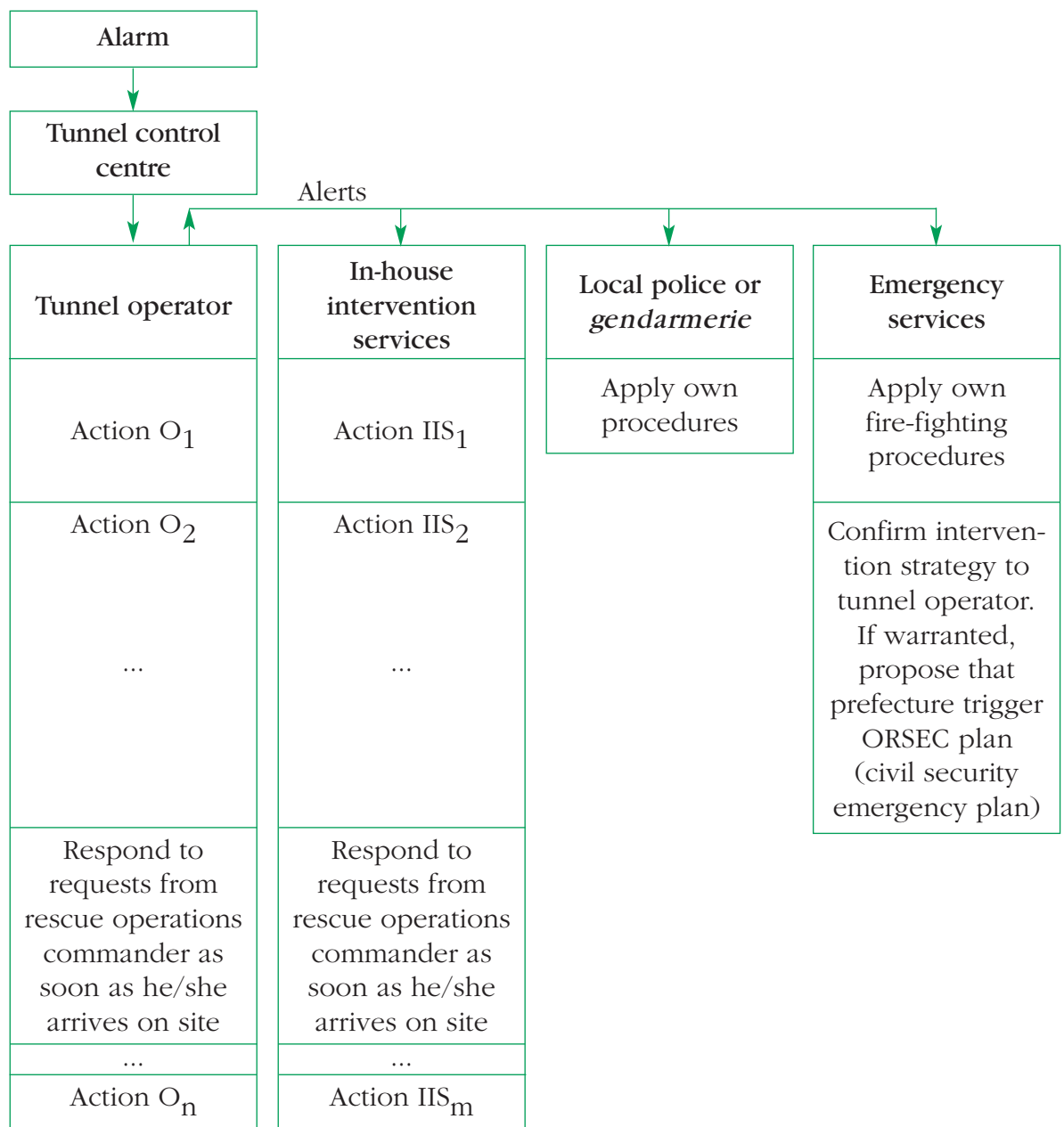
4.2. Flowcharts of actions taken by the tunnel operating body and outside emergency services

For each incident taken into account, the general action principles within the scope of the Emergency Response Plan are described in a flowchart which defines the actions to be taken by the tunnel operating body and the order in which they are taken. It also indicates how they interrelate with the action principles of outside emergency services, and thus highlights the various interactions in dealing with the incident.

These flowcharts are destined primarily for the tunnel operating body, but also for outside services. They enable the tunnel operating body and the duty manager to quickly ascertain the organisational principles in the event of a crisis situation.

They are drawn up when the Emergency Response Plan is written or updated, and must systematically be updated whenever the intervention principles are revised (for example based on lessons learnt from an exercise or from a detailed analysis of actual events). They form an integral part of the Emergency Response Plan.

The flowcharts also define the context in which the operating instructions (not included in the Emergency Response Plan) are to be drawn up. The flowcharts follow the outline given below.



Appendix C includes a number of examples of completed flowcharts, corresponding to the following two events occurring in a tunnel with two-way traffic:

- Vehicle stopped or broken down, partially blocking a traffic lane.
- Vehicle on fire.

Each event is set out for two different staffing and surveillance levels:

- Level D2, duty staff with action resources.
- Level D4, continuous human surveillance.

For a tunnel with level D3 surveillance, the action principles may differ depending on whether an event occurs during working hours (tunnel operator present at control centre) or non-working hours (no tunnel operator present). This difference must be taken into account in preparing the Emergency Response Plan and the flowcharts in particular.

4.3. Remedial measures

If an event or a significant technical malfunction occurs, tunnel operation passes from usual mode (green zone) to degraded mode (orange zone). We have seen that in degraded operating mode the tunnel operating body may apply one or more remedial measures to enable tunnel operation to continue until the incident is over.

A few examples of remedial measures are set out below:

For an event related to traffic or the tunnel environment, the tunnel operator may for example:

- Lower the speed limit upstream from the tunnel.
- Close a lane (in a tunnel with more than one lane in each direction).
- Set up alternating traffic outside the tunnel.

For a technical malfunction, the remedial measures might include:

- A patrol driving continuously back and forth through the tunnel.
- Assigning a video monitor to a particular camera to in order to continuously monitor the area of the tunnel affected by the technical malfunction.
- Closing a lane.
- Prohibiting access to the tunnel for a particular category of vehicle (e.g. dangerous goods and/or heavy goods vehicles) and diverting this traffic onto an alternative route.
- Escorting vehicles of a particular category through the tunnel in convoys.

These remedial measures may have associated time limits if they become insufficient or are very difficult to maintain for a longer duration.

4.4. Instruction Books

Every tunnel must have an Instruction Book drawn up by the tunnel operating body and kept continually available. Instruction books are not included in the Emergency Response Plan or the safety documentation.

The two references in the safety documentation setting out operating arrangements are as follows:

- The description of the organisation, human and material resources and measures planned by the owner of the tunnel to ensure safe operation and maintenance.
- The Emergency Response Plan, which covers only events liable to affect the safety of people.

The operational details resulting from these two documents are set out in the Instruction Book which contains a detailed description of the elementary actions to be taken by all members of the tunnel operating body's staff (tunnel operator, patrol teams, duty manager, etc.) together with the corresponding resources for each action.

The general organisational principles for exceptional situations relating to work on the tunnel are set out in a special maintenance and repair operations file which defines the corresponding operating instructions.

Instructions are written when the Emergency Response Plan is drawn up and updated whenever the flowcharts mentioned above are updated.

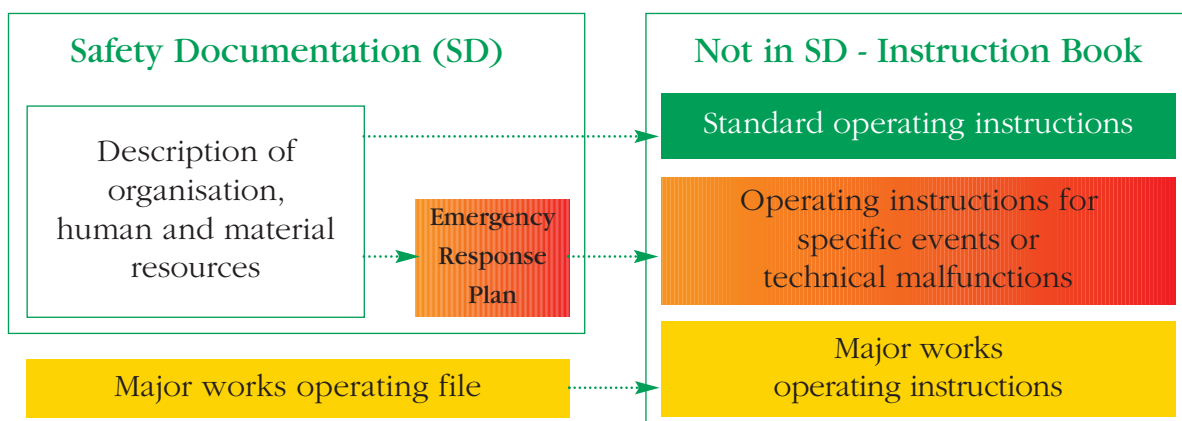


Figure 2: interaction between Emergency Response Plan and Instruction Book

The Instruction Book is an essential reference document when managing a usual event or an emergency. It is destined for parties directly involved in handling the event (tunnel operator, patrol teams, duty manager, etc.). The Instruction Book must always be kept available for tunnel operators in the control room, the control room manager's office, the duty call-out kit and in patrol vehicles. Where warranted, it can be useful to define specific Instruction Books for different functions. Note that for tunnels which have a tunnel management system the instructions are largely integrated in the computer system.

Section A

Emergency Response Plan specific application conditions

5.1. Specific application conditions

Under certain specific operating conditions it may be necessary to adapt the general requirements laid down in the Emergency Response Plan. An example would be a tunnel with two traffic tubes that is temporarily used in a single tube bidirectional traffic configuration for various reasons (maintenance, repairs, accidents, etc.).

These specific conditions may have a direct effect on the action flowcharts for the tunnel operating body and outside emergency services, and on the resulting instructions.

The action principles for these specific operating conditions should be included in the Emergency Response Plan if they are liable to occur relatively frequently. For more exceptional situations (e.g. repair work) the principles are set out in the major works operating documentation.

5.2. Tunnel closure conditions

Conditions for tunnel closure are discussed in the CETU Recommendations “Road tunnel closure — Tunnels without recurring congestion” (September 2002). As that document states, the following situations may require the tunnel to be closed:

- Scheduled closure for regular, everyday work (e.g. washing or maintenance).
- Unscheduled event not corresponding to an emergency (e.g. incident or fault);
- Unscheduled event resulting in an emergency situation (e.g. fire or serious accident).

The first case corresponds to an ordinary situation not within the scope of an Emergency Response Plan. The other two cases, however, correspond to situations which may affect the safety of people and should therefore be taken into account and described in the Emergency Response Plan. The party responsible for closing the tunnel should also be defined in the plan.

5.3. Reopening conditions

5.3.1. Return to normal conditions or to degraded conditions set out in the Emergency Response Plan

The tunnel must remain closed until the event has been dealt with and the minimal operating requirements are met again. These conditions correspond to a return to the green zone (normal situation) or orange zone (degraded operation with remedial measures) in figure 1.

After the outside emergency services have authorised the tunnel operating body to reopen the tunnel, and once checks have been made to ensure that the tunnel equipment and structure are in good condition, it may be reopened to traffic.

5.3.2. Exceptional situations

Once a decision has been made to close the tunnel, the terms of the Emergency Response Plan must not prevent the prefect from defining exceptional and appropriate conditions for reopening. One example would be a partial failure of the tunnel's ventilation system. Depending on the situation and, if necessary, subject to expert approval, the prefect may set out special temporary measures and decide to reopen the tunnel subject to these measures being applied (e.g. reduced number of lanes, traffic restricted to light vehicles, intervention services continuously present, etc.).

Notes

Section A

Recommendations for drawing up an Emergency Response Plan

The tunnel operating body is the main party involved in drawing up an Emergency Response Plan. While the plan falls under the tunnel operating body's responsibility, it is essential that all parties with a stake in safety also participate. For tunnels over 500 m in length and forming a part of the trans-European network, the safety officer must be involved in drawing up and updating the Emergency Response Plan.

The Emergency Response Plan must take account of the lessons learnt from the scenarios included in the specific hazard investigation for the tunnel. This investigation describes accidents, regardless of origin, which are liable to occur during tunnel operation and sets out the nature and extent of their potential consequences. It also details and explains specific measures intended to reduce the probability of such accidents occurring and limit their consequences.

6.1. New tunnels

The tunnel opening permit is issued on the basis of the safety documentation sent by the owner to the prefect. Given the time needed to review the application, the Emergency Response Plan must be available for inclusion in the documentation at least four months before the tunnel is due to open.

Regardless of this deadline, it is in any case important to start considering operational arrangements, including safety interventions, as early as possible, in particular to define the operating assumptions which have a direct effect on the overall design of the tunnel.

6.2. Existing tunnels

For tunnels already in operation the Emergency Response Plan must be drawn up on the basis of the condition of the tunnel at a given time and must be updated by the tunnel operating body as required, in conjunction with outside emergency services. Updates are necessary in the following cases in particular:

- Whenever the organisational arrangements are substantially modified, smooth coordination between all participants concerned is essential. All the corresponding provisions must be fully integrated into the Emergency Response Plan.

- New equipment installed may alter how events are handled. This relates in particular to certain phases of renovation work on existing tunnels.
- After annual safety exercises are held or if significant incidents or accidents occur, it may be useful to adapt the Emergency Response Plan to take account of lessons learnt.

Changes in the contact details of services listed on the alert diagram should be updated quickly and notified to all parties concerned.

Notes

Section A

Interactions with other plans

7.1. Routes comprising several tunnels

If a number of tunnels on a given route are managed by a single tunnel operating body, an overall Emergency Response Plan may be drawn up to set out the operational and organisational arrangements common to all the tunnels. In addition, individual sections specific to each tunnel are also drawn up and must of course be consistent with the overall Emergency Response Plan.

7.2. Motorway routes

The arrangements for operation and safety on each motorway route are covered by a Motorway Emergency Response Plan. A Traffic Management Plan also sets out the measures to be taken for all events affecting the motorway. This procedure is stipulated by the concession requirement specifications for conceded motorways and is also being progressively applied to publicly-operated motorways.

The Motorway Emergency Response Plan defines the measures taken by the motorway operating body for the following aspects under its responsibility:

- Surveillance of the conceded section.
- Preservation of the section.
- Operation of the motorway.
- Installation and maintenance of alert mechanisms.
- Interventions to ensure traffic continuity and safety.
- Assistance to outside services authorised to intervene on the motorway.
- Assistance to users.
- Relations with administrative authorities.

If an Emergency Response Plan exists for the motorway it is important to ensure that it is consistent with the Emergency Response Plan for the tunnel. This can be done by integrating the Emergency Response Plan for the tunnel in the overall plan for the motorway, thereby avoiding any redundancy while highlighting the specifics of the tunnel.

7.3. Operational arrangements of outside emergency services

Each outside emergency service has its own procedures. The tunnel operating body should be consulted when the operational arrangements are drawn up.

7.4. Interaction with the civil security emergency plan (ORSEC)

In certain situations the nature or scale of the events to be handled (rescuing people, traffic policing) requires the intervention of specialised services or additional external resources. The provisions of the civil security emergency plan (ORSEC) are therefore applied by decision of the competent authorities. The Emergency Response Plan must include details of the requirements imposed on the tunnel operating body in order to cater for the provisions of the emergency plan.

Although the ORSEC plan is defined by the external parties concerned, the tunnel operating body should be involved where possible in drawing up the specific parts of the plan relating to the tunnel.

Notes

Part B - Emergency Response Plan template and explanations

This section sets out practical recommendations for drawing up an Emergency Response Plan, in the form of a template with explanations.

The template given below remains very general; the content of the document should of course be adapted to take into account factors specific to each tunnel. One important factor is the level of staffing and surveillance, which varies significantly from one tunnel to another. A number of levels are defined, from no surveillance (level D1) to highly sophisticated supervision where the tunnel operating body has a wide range of information available enabling rapid interventions at any time (level D4).

Following the template in the left hand column of the table below is highly recommended when drawing up an Emergency Response Plan. The right hand column gives advice for writing the various sections of the document.

Template	Comments on content and methods for drawing up each section
<p>1. INTRODUCTION</p>	<ul style="list-style-type: none"> • Briefly describe the tunnel. • List the parties involved in drawing up the plan. • Specify whether the plan is drawn up: <ul style="list-style-type: none"> – based on the reference condition for a new tunnel or after substantial modifications, or – based on the actual condition at the time of writing, for a tunnel in operation. • Indicate the period for which the tunnel condition taken into account is valid. • Give references of the application documents setting out the methods used by the tunnel operating body’s staff (Instruction Book in particular). • Give references of other relevant emergency plans.
<p>2. BRIEF DESCRIPTION OF TUNNEL</p>	<p>The brief description of the tunnel included in the Emergency Response Plan should provide the reader with enough information to apprehend the tunnel, its characteristics and its environment without needing to refer systematically to the safety documentation. Photos, diagrams and other illustrations may be used as appropriate.</p> <p>The description should pay particular attention to the following aspects:</p> <ul style="list-style-type: none"> • Tunnel geometry and civil engineering structures, including in particular safety recesses, emergency exits and access points, with their locations.

2. BRIEF DESCRIPTION OF TUNNEL (continued)	<ul style="list-style-type: none"> • Operating and safety equipment (electrical power supplies, water drainage, lighting, ventilation, smoke extraction, atmospheric analysis sensors, tunnel management system, radio broadcasting facilities, remote surveillance systems, lane signals, traffic counting systems, variable message signs, access gates, etc.). <p>Note that the tunnel safety documentation also includes a complete and detailed description of the tunnel, with the diagrams needed to fully understand the design and the operating arrangements. The Emergency Response Plan should not reiterate all these details.</p>
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3. TUNNEL OPERATING BODY'S ORGANISATION

3.1. General presentation	<p>There may be significant organisational differences from one tunnel to another, or even at different times for a given tunnel. This section should therefore:</p> <ul style="list-style-type: none"> • List all relevant members of the tunnel operating body's services (tunnel operator, duty manager, patrols, dedicated fire-fighters, maintenance team, etc.). • State their roles. • Set out the relations between them and the outside parties liable to be called in.
3.2. Brief description of standard operation	<p>This section should provide an overview of standard operating conditions and duty organisation for the members of the tunnel operating body's services listed in section 3.1. above. The operational organisation and resources are described in full elsewhere in the safety documentation. This section merely provides a summary to help readers understand how events are handled.</p>
3.3. Description of the tunnel operating body's organisational principles for events within the scope of the plan	<p>This section should include a high-level description of the following aspects in particular:</p> <ul style="list-style-type: none"> • The levels of responsibility and the chain of command (specifying in particular the role of the chief tunnel operator if such a position exists). • How internal resources are coordinated. • How coordination with external services is organised. • Logging methods designed to keep traces of events, decisions and actions taken during operation.

4. SCOPE OF EXTERNAL PARTIES' ACTIONS

4.1. General presentation	<p>The external parties include the prefecture, the services responsible for managing the route and other roadways, external control centres, outside emergency services (police and <i>gendarmerie</i>, public emergency services), others (roadside assistance, subcontractors).</p> <ul style="list-style-type: none"> • List all these parties and define their respective responsibilities. • State the links between these parties and the tunnel operating body.
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<p>4.2. Organisational overview</p>	<p>The organisation of outside emergency services (law enforcement services, rescue services) must be described briefly. For each service the Emergency Response Plan must:</p> <ul style="list-style-type: none"> • State their general tasks. • List the human and material resources liable to be used. • Indicate the means of alerting them. • Specify the arrangements for their interventions. <p>The Emergency Response Plan should only provide details of those aspects of the emergency services' organisational provisions which the tunnel operating body needs to be aware of in order to make appropriate arrangements (access location, means of arrival on site, extent of resources mobilised, potential parking locations, etc.).</p> <p>For other outside participants the plan should simply state their roles, list the resources they can apply to facilitate the handling of an event and indicate the means of alerting them.</p>
<p>5. GENERAL ARRANGEMENTS FOR ALERTING AND CALLING THE VARIOUS PARTIES</p>	<p>An overall alert diagram should set out how alerts received at different points are transmitted to the various parties. The contact details for the various services should be appended to this diagram (See appendix A).</p> <p>Coordination with other services is facilitated if a standard list of information to be provided in the event of an alert is defined.</p>
<p>6. DEGRADED OPERATING MODES AND MINIMAL OPERATING REQUIREMENTS</p>	<p>This section should define the nominal operating conditions, degraded operating modes and minimal operating requirements for each item of equipment or, where applicable, for each equipment category or combination of categories.</p> <p>It is also useful to set out the various possible operating modes for human resources (e.g. for tunnel operators).</p> <p>The following aspects of operating conditions should be detailed as part of the definition of degraded and minimal operating requirements:</p> <ul style="list-style-type: none"> • Quantitative unavailability threshold. • Remedial measures to be applied. • Maximum acceptable duration. <p>The operating measures to be taken by the tunnel operating body in each case should be described (maintenance level to be scheduled, remedial measures to be applied, etc.).</p> <p>This section must also give details of the provisions for closing the tunnel (moving from the orange zone to the red zone of the operating situations diagram in figure 1).</p>

<p>7. FLOWCHARTS OF ACTIONS TAKEN BY THE TUNNEL OPERATING BODY AND OUTSIDE EMERGENCY SERVICES</p>	<p>These flowcharts are drawn up jointly by the tunnel operating body and the outside emergency services on the basis of relevant incident scenarios for the tunnel.</p> <p>For each incident or category of incidents the corresponding flowchart sets out the general principles for the actions of the various parties involved in handling the crisis.</p> <p>Appendices C and F give examples of flowcharts applicable to the following cases:</p> <ul style="list-style-type: none"> • Traffic-related events. • Technical malfunctions. <p>These flowcharts only list the outside emergency services; where applicable these services contact other relevant outside parties.</p>
<p>8. GLOSSARY OF SPECIALISED TERMINOLOGY</p>	<p>Experience shows that an Emergency Response Plan will be clearer and easier to understand if the reader is fully aware of the abbreviations and terminology used. It is therefore recommended to include a reminder of the definitions of the main specialised terms used.</p> <p>The glossary given in the appendix to this booklet may provide a useful starting point.</p>
<p>9. LIST OF RECIPIENTS OF THE EMERGENCY RESPONSE PLAN</p>	<p>As well as simply listing the parties who receive copies of the Emergency Response Plan, this section can be of use when distributing future updates or setting up working parties to revise the document.</p>
<p>APPENDICES</p>	<p>The appendices to the Emergency Response Plan should include descriptive documents useful in understanding the context (layout diagram, file of plans where appropriate, etc.) and simple factual information that may be updated regularly (lists of contacts, phone numbers, etc.).</p>

Appendices

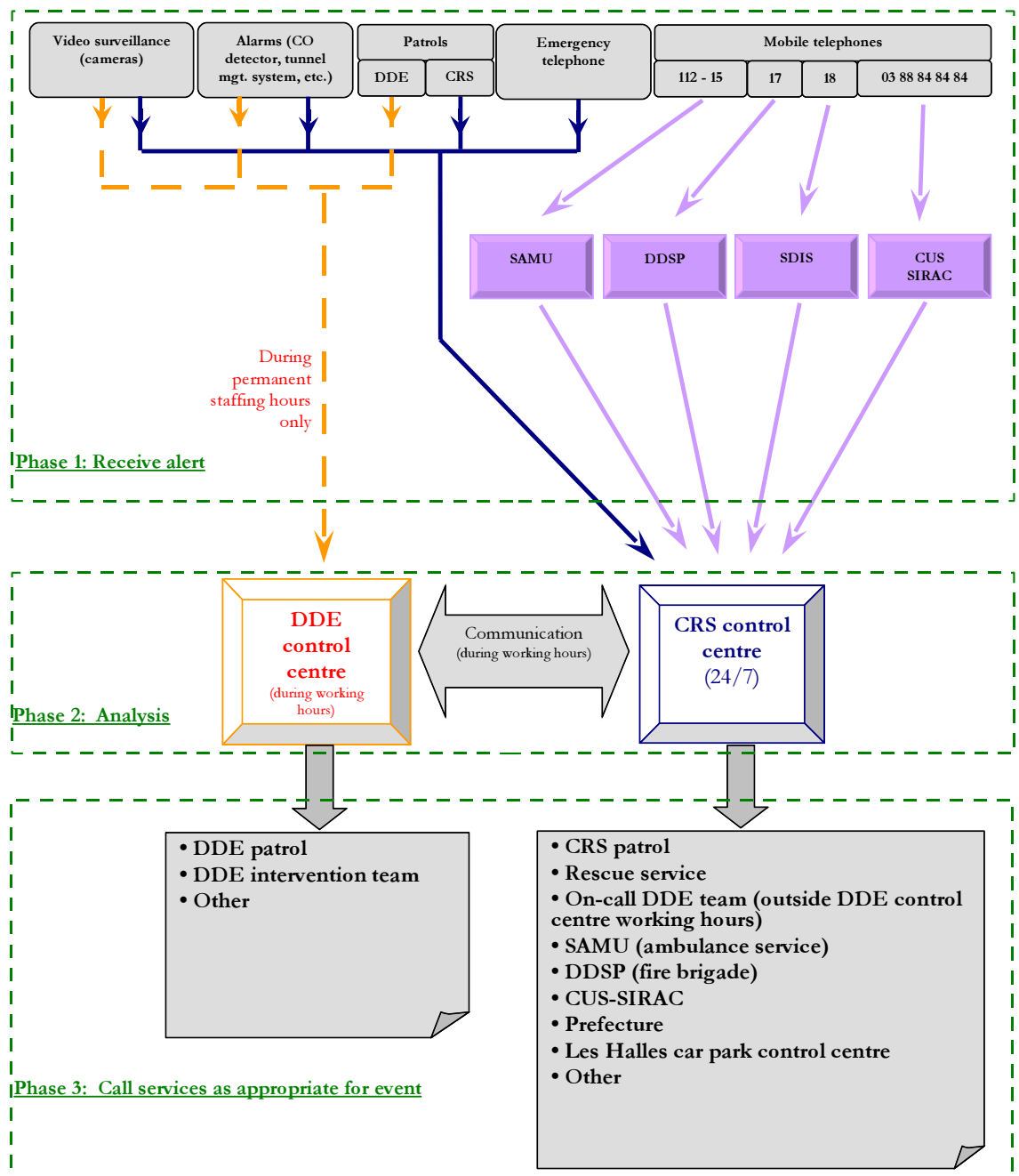
- Appendix A** ■ **Example of overall alert diagram**
A.1
- Appendix B** ■ **Indicative lists of incidents to be taken into account in drawing up the flowcharts**
B.1 to B.2
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- Appendix E** ■ **Examples of degraded operating modes**
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- Appendix G** ■ **Glossary of specialised terminology**
G.1 to G.2

Example of overall alert diagram

(see example below)

The alert trigger procedure comprises three separate phases:

- Information received by the tunnel operator or surveillance service.
- Information analysed in accordance with applicable procedures.
- Internal and external services called (transmission of alert).



Source: SCETAUROUTE - Excerpt from Emergency Response Plan for Les Halles tunnel (Strasbourg)

Indicative* lists of incidents to be taken into account in drawing up the flowcharts

B.1. Events affecting traffic

The severity thresholds for the events depend completely on the context for each tunnel. An event occurring in a given tunnel might lead to remedial measures being taken and the traffic flow maintained, whereas in another tunnel the same event would require the tunnel to be closed.

The first list below corresponds to events affecting traffic. The events corresponding to each of the two severity thresholds are given as an example, but the breakdown could differ depending on the context of the particular tunnel.

First threshold (remedial measures potentially applied)
Slow traffic
Object on roadway
Stray animal
Unauthorised pedestrian or user
Dangerous driving: swerving, particularly slow speed
Loose load
Vehicle broken down in traffic lane
Minor accident in traffic lane
Second threshold
Demonstration
Tailbacks ahead of tunnel exit, stretching back into tunnel
Tailback in tunnel
Incident involving dangerous goods transport, with a risk of hazardous or toxic product spillage
Serious accident, pile-up
Accident involving dangerous goods transport
Avalanche or landslip on access roads
Vehicle stopped or broken down, giving off smoke
Fire
Bomb warning and/or suspicious object discovered (in any location)
Explosion
Acceptable pollution threshold in tunnel exceeded

* These lists are not exhaustive and should be completed and adapted to the local context.

B.2. Unavailability of human resources and/or equipment

The various types of malfunction (e.g. partial or total failure of certain equipment) should be quantified precisely (see section 3.5.) and adapted to the local context. For example, in certain tunnels, operation with one in two or one in three emergency telephones may be acceptable; unavailability of one telephone for one week may be classified under the first threshold, whereas if this situation continued for two months it might be updated to the second threshold.

The second list below corresponds to technical failures or malfunctions. The events corresponding to each of the two failure thresholds are given as an example, but the breakdown could differ depending on the context of the particular tunnel.

First threshold (remedial measures potentially applied)
Very partial loss of ventilation
Partial loss of emergency telephone network
Partial loss of video
Partial loss of traffic signs
Partial loss of lighting (normal or emergency)
Loss of one tunnel management system PLC
Loss of certain sensors
Second threshold
Loss of ventilation
Total loss of traffic signs
Total loss of emergency telephone network
Total loss of video
Total loss of lighting
Total loss of power supply
Total loss of tunnel management system
Total loss of sensors
Personnel on strike

Example flowcharts showing actions taken by the tunnel operating body and outside services in order to handle traffic-related events

The example flowcharts below correspond to the following two events occurring in a tunnel with two-way traffic:

- Vehicle stopped or broken down, partially blocking a traffic lane.
- Vehicle on fire.

Each event is set out for two different staffing and surveillance levels:

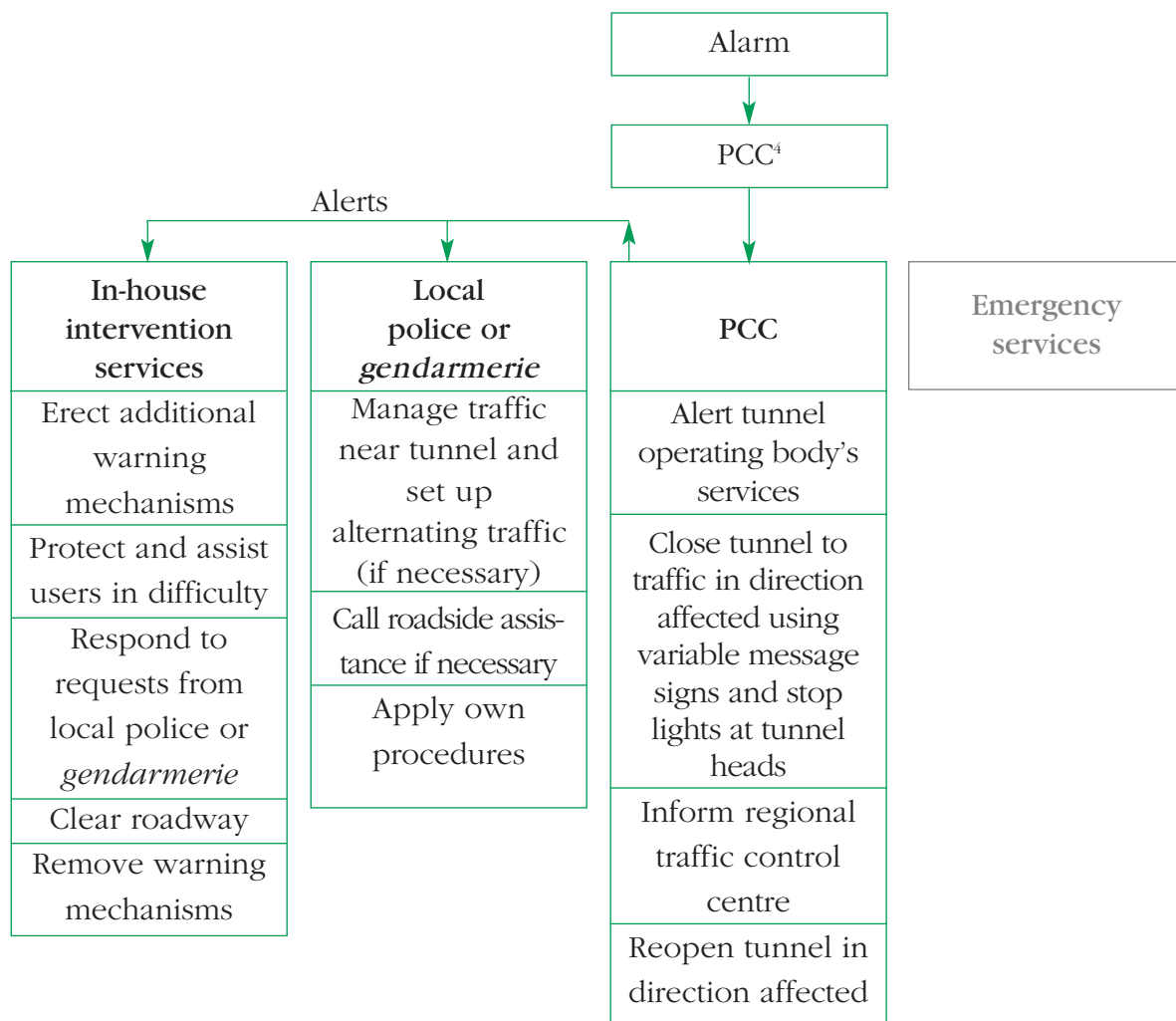
- Level D2, duty staff with action resources
- Level D4, continuous human surveillance.

These four examples are given for illustrative purposes only, with the aim of showing the desirable level of detail. The details must of course be adapted to the context of each individual tunnel.

Action flowchart example 1

Tunnel with two-way traffic, duty staff with action resources (surveillance level D2)

Vehicle stopped or broken down, partially blocking a traffic lane

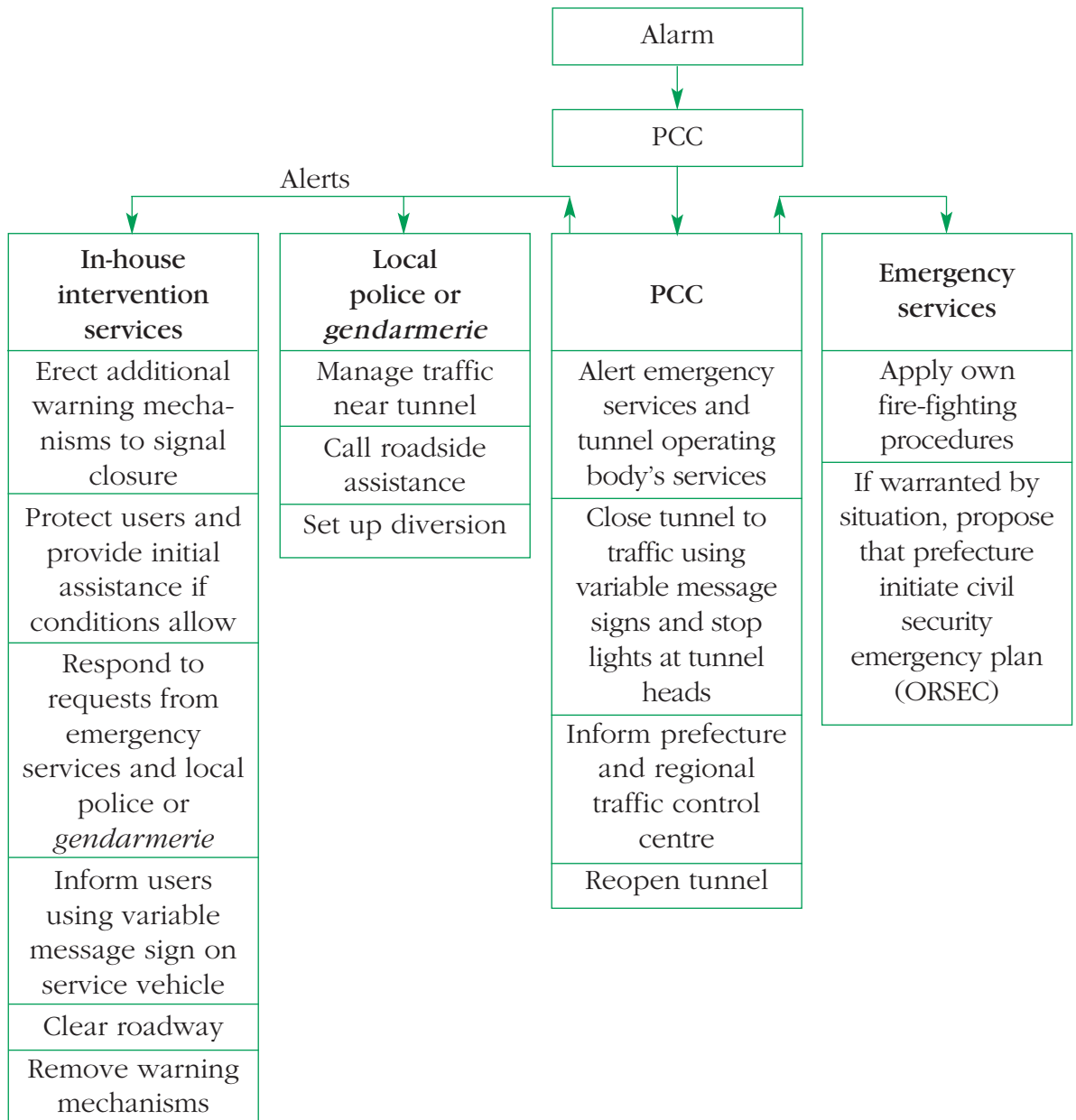


⁴ Police control centre.

Action flowchart example 2

Tunnel with two-way traffic, duty staff with action resources (surveillance level D2)

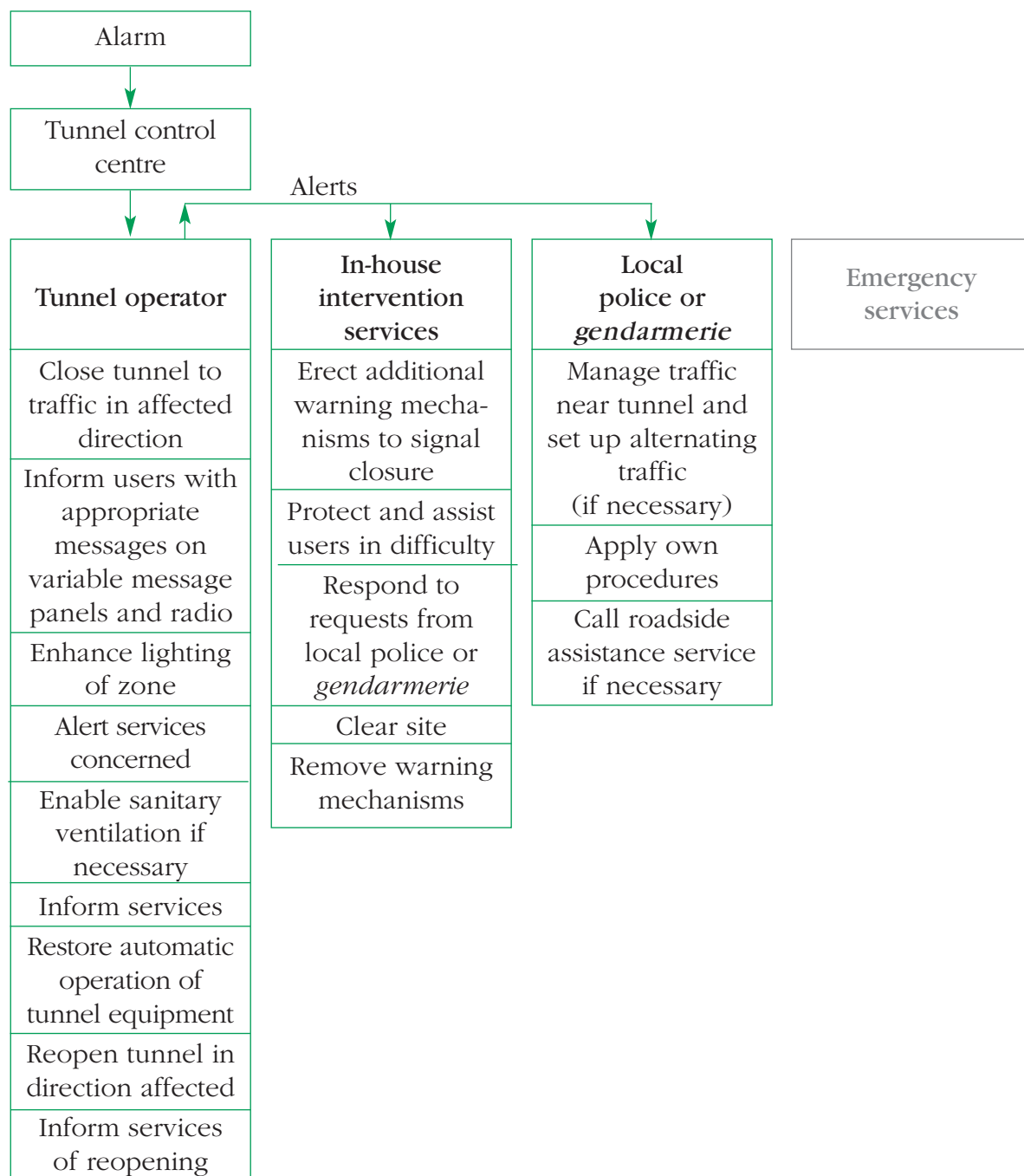
Vehicle on fire



Action flowchart example

Tunnel with two-way traffic and continuous human surveillance (D4)

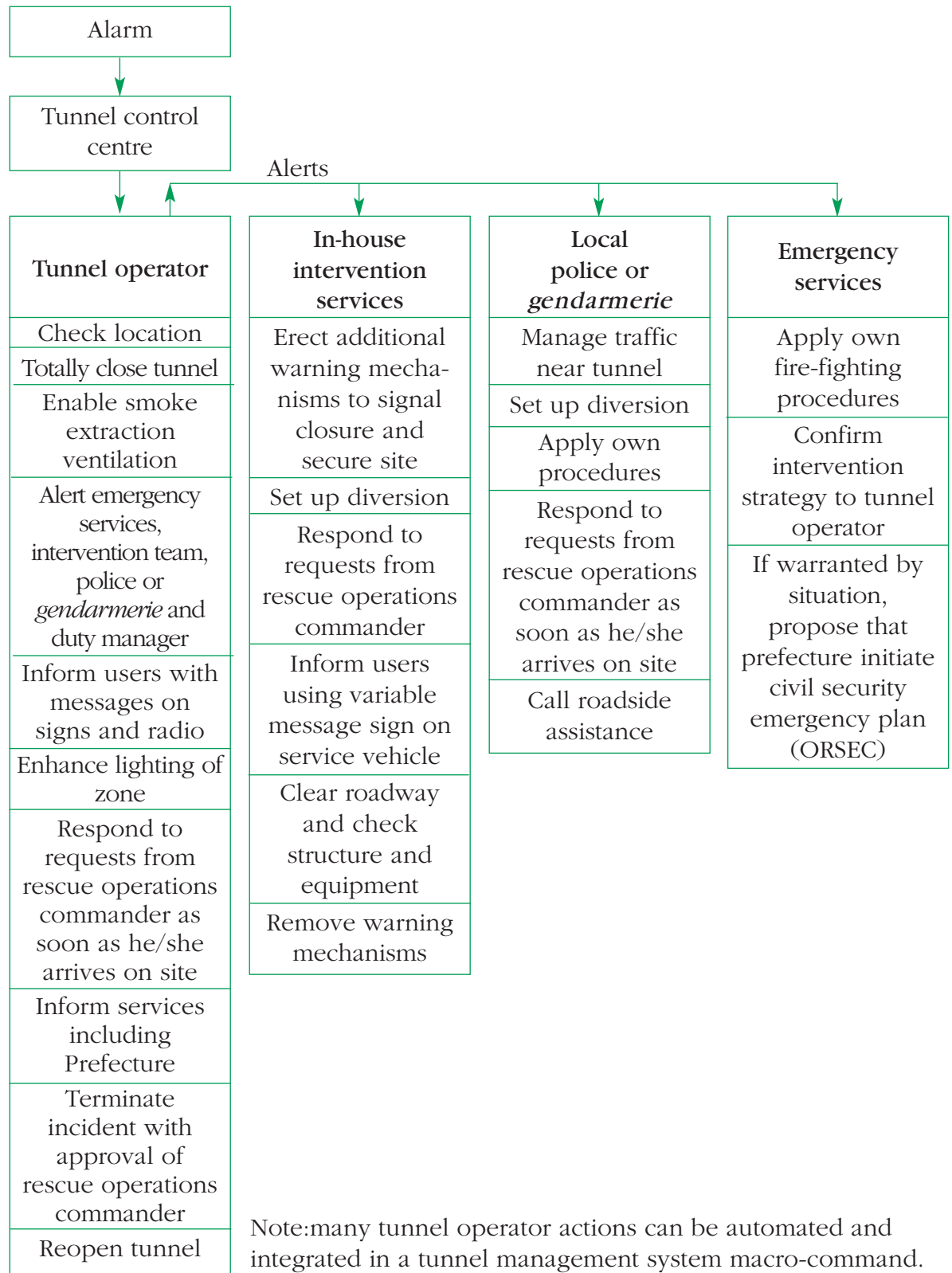
Vehicle stopped or broken down, partially blocking a traffic lane



Action flowchart example

Tunnel with two-way traffic and continuous human surveillance (D4)

Vehicle on fire



Example instruction sheets

The instruction sheets below correspond to the flowchart in example 4 (Appendix C) relating to a fire in a tunnel with permanent human surveillance (D4). They are not included in the Emergency Response Plan.

Tunnel operator in control centre .

1 - Receive and handle alarm:

Check and locate the fire.

Run the “fire” macro-command.

Start video recording.

Alert the following services for action and priority information:

- emergency services,
- the intervention team, noting specific instructions for fire in tunnel,
- local police or *gendarmerie*,
- duty manager.

See
macro-command
overleaf

2 - Handle event:

Check that the commands in the macro-command have been applied correctly. If not, activate each command manually.

Respond to requests from the rescue operations commander as soon as he/she arrives on site.

Monitor the situation on all cameras, including in exits and shelters.

Monitor sensor information and inform the rescue operations commander.

Inform the services on **list X** by fax every 30 minutes or following significant developments. Check automatic transmission of faxes and send manually if necessary.

Activate **traffic management procedure XX**.

Terminate incident with the approval of the rescue operations commander.

Disable fire macro-command.

Inform in-house intervention services of end of fire.

See
procedure XX
overleaf

See
list X
overleaf

3 - Return to normal:

Reopen tunnel when instructed by rescue operations commander, local police or *gendarmerie* and duty manager.

Resume automatic operation of technical facilities in tunnel.

Inform the services on **list X** by fax.

Check automatic transmission of faxes and send manually if necessary.

Record the event in the log.

Complete the feedback sheet.

Fire macro-command

Activate tunnel closing sequence (early warning on variable message signs “Tunnel closed, no access x km ahead.”, speed limit, stop lights, gates, automatic signs).
Implement appropriate automatic smoke extraction procedure depending on location of fire.

Pressurise emergency exit and shelter airlocks to positive pressure.

Set lighting to high (day) for entire tunnel.

Broadcast a radio message instructing users to leave their vehicles and go to the nearest emergency exit or shelter.

Close drain valves on retention basins.

List X

Emergency services	0xxx xx xx xx
Police control centre	0xxx xx xx xx
Prefecture	0xxx xx xx xx
FM radio	0xxx xx xx xx
Traffic control centre	0xxx xx xx xx

Traffic management procedure XX

Display on variable message signs “Compulsory diversion xx km ahead. Tunnel closed, no access.”

Broadcast an FM radio message.

Informs local police or *gendarmerie* and regional traffic control centre.

In-house intervention services

1 - Receive and handle alarm:

Confirm to the tunnel operator that the alert has been received.

Go on site.

Inform tunnel operator of situation.

Provide initial information to users at tunnel entrance.

2 - Handle event:

Erect additional warning mechanisms to signal tunnel closure.

Wait at tunnel head and take instructions from rescue operations commander, police or *gendarmerie*.

Await notification of end of fire.

Facilitate access of roadside assistance services with approval of rescue operations commander.

Clear roadway after vehicles removed.

3 - Return to normal:

Check the condition of the roadway and technical equipment in the tunnel, and if appropriate propose to the rescue operations commander and police or *gendarmerie* to open the tunnel by agreement with the duty manager.

Briefly record any damage to the tunnel.

Remove the additional tunnel closure warning mechanisms.

Inform the tunnel operator of any damage to the tunnel equipment or structure.

Draw up an intervention report.

Examples of degraded operating modes

The following examples illustrate degraded operating modes applicable to two equipment categories (booster fans and video surveillance cameras) and human resources (tunnel operators in control centre).

The maintenance levels listed in the tables correspond to the following lead times (to repair the equipment concerned):

- Routine maintenance: the operation must be performed within six weeks of the fault; this maintenance mode only applies to day-to-day operations.
- Expedited maintenance: the operation must be performed within one week.
- Emergency maintenance: the operation must be performed within four hours.

Booster fan units		
Condition	Definition of condition	Measures to be taken
Nominal	8 booster fan units operating	N/A
Degraded 1	Quantitative unavailability: 2 of 8 booster fan units. Remedial measure: none. Maximum acceptable duration: 1 week.	Schedule expedited maintenance.
Degraded 2	Quantitative unavailability: 3 of 8 booster fan units. Remedial measure: tunnel prohibited for dangerous goods transport. Maximum acceptable duration: 1 week	Schedule emergency maintenance. Set up prohibition signs and associated information measures. Police or <i>gendarmerie</i> verify compliance with prohibition.
MOR	Quantitative unavailability threshold: 4 of 8 booster fan units. Remedial measure: tunnel prohibited for dangerous goods transport and heavy goods vehicles. Maximum acceptable duration: 1 week.	Schedule emergency maintenance. Inform fire brigade and police or <i>gendarmerie</i> . Set up prohibition signs and associated information measures. Police or <i>gendarmerie</i> verify compliance with prohibition.

In this example, under minimal operating requirements, if a fifth booster fan unit becomes unavailable or if the remedial measure is no longer feasible, the tunnel must be closed to traffic immediately.

Video surveillance		
Condition	Definition of condition	Measures to be taken
Nominal	All cameras operational	N/A
Degraded 1	Quantitative unavailability: 10% (non-consecutive cameras) Remedial measure: none. Maximum acceptable duration: 1 week.	Schedule expedited maintenance.
Degraded 2	Quantitative unavailability: 30% (non-consecutive cameras) Remedial measure: emergency call system operational throughout tunnel. Maximum acceptable duration: 4 hours.	Schedule emergency maintenance. Check correct operation of emergency telephones.
MOR	Quantitative unavailability threshold: 2 consecutive cameras Remedial measure: corresponding emergency telephones operational; heightened surveillance on site. Maximum acceptable duration: 4 hours.	Schedule emergency maintenance. Check correct operation of emergency telephones concerned. Set up heightened surveillance.

In this example, under minimal operating requirements, if one of the criteria is no longer met, the tunnel must be closed to traffic immediately.

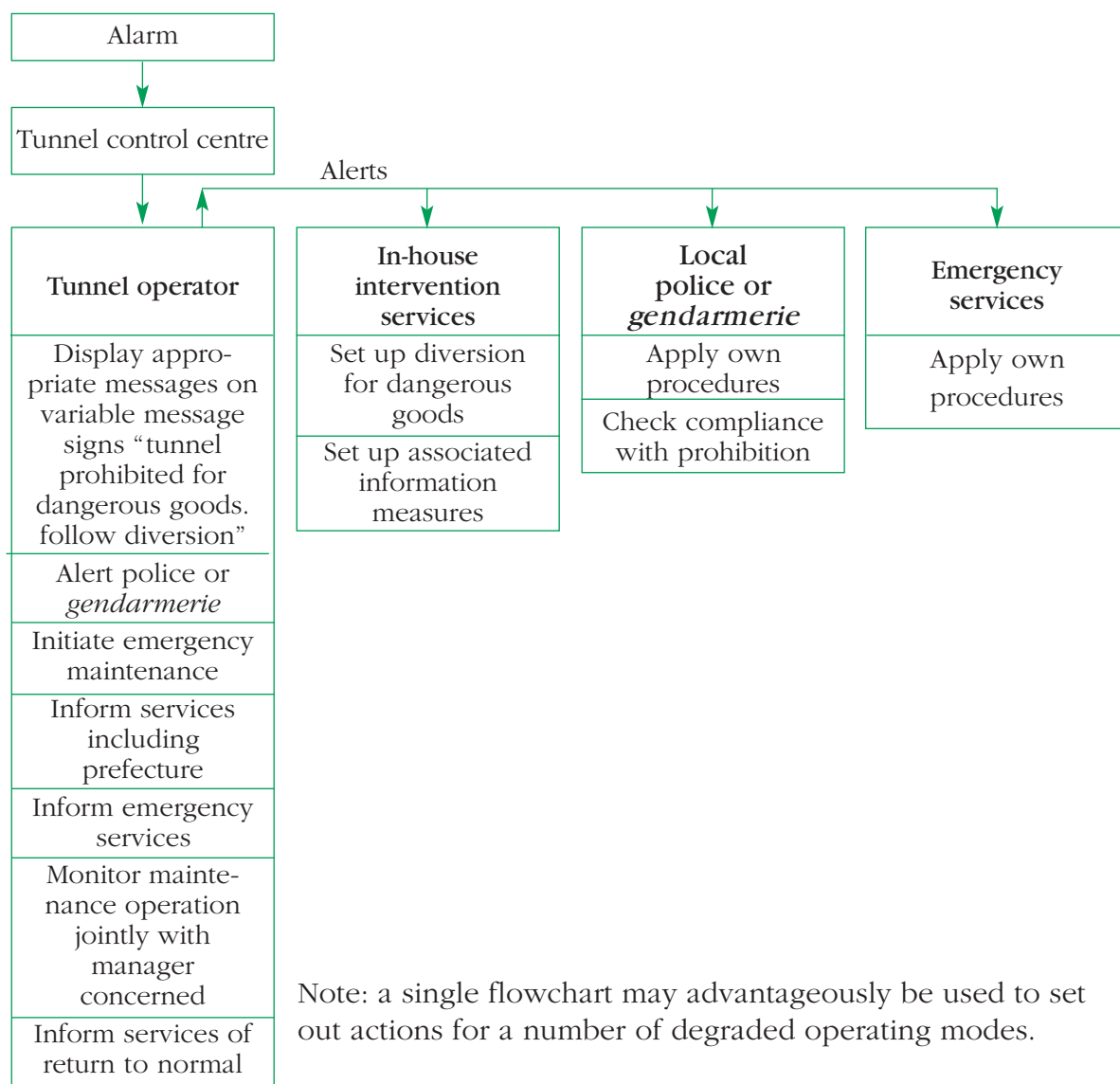
Organisational provisions relating to tunnel operators		
Condition	Definition of condition	Measures to be taken
Nominal	2 tunnel operators per shift	N/A
Degraded	Quantitative unavailability threshold: 1 tunnel operator Remedial measure: none. Maximum acceptable duration: no limit.	N/A
MOR	Quantitative unavailability threshold: 2 tunnel operators. Remedial measure: Bring in an on-call operator as a replacement. Maximum acceptable duration: 48 hours.	Organise replacement, adapt tunnel operator schedule for subsequent days if necessary.

In this example, under minimal operating requirements, if one of the criteria is no longer met, the tunnel must be closed to traffic immediately.

Example flowchart showing actions taken by the tunnel operating body and outside services in order to handle technical malfunctions

Note that for each equipment category we define several operating modes, from nominal down to minimal operating requirements (MOR), with one or more intermediate degraded operating modes (see section 3.5.). The example below shows a flowchart for technical malfunctions. It relates to a tunnel with two-way traffic and permanent human surveillance (D4) and corresponds to a malfunction of the booster fan units set out in appendix E (degraded mode 2):

- Quantitative unavailability: 3 of 8 booster fan units.
- Remedial measure: tunnel prohibited for dangerous goods transport.
- Maximum acceptable duration: 1 week.



Glossary of specialised terminology

- **Alarm:** audible and/or visual signal intended to stimulate the tunnel operator or duty staff.
- **Alert:** the action of requesting intervention by a service concerned by a significant event (event affecting traffic, or failure of human resources or equipment).
- **Closure of tunnel:** this measure may be appropriate for the following three configurations:
 - Scheduled situation (cleaning or maintenance).
 - Unscheduled event not corresponding to an emergency (e.g. incident or fault).
 - Emergency situation (fire or serious accident).
- **Degraded operation:** a situation characterised by reduced availability of personnel and/or equipment and requiring remedial measures to be taken. The remedial measures may relate to personnel and/or equipment and/or traffic (regulation).
- **Tunnel operator** (supervisor, control system operator or regulator): person responsible for monitoring traffic and controlling equipment from the tunnel control centre.
- **Event** (traffic and environment): disturbance to operating conditions, liable to adversely affect the safety of tunnel users.
- **Failure or malfunction (equipment):** fault or abnormal operation of one or more items of equipment for a given duration.
- **Flowcharts of actions taken by the tunnel operating body and external services** describe, for each event or incident, the general action principles under the Emergency Response Plan. The purpose of these flowcharts is to define and plan generic actions to be taken by operating personnel (tunnel operator, patrols, supervisors, duty manager) and indicate the principle for actions taken by external services, in a way that demonstrates the interactions.
- **Instruction sheets** describe the elementary actions to be taken by all members of the tunnel operating body's organisation (duty manager, tunnel operator, patrol team, etc.).

The instructions are collected in an Instruction Book (a living document, updated regularly) rather than being included directly in the Emergency Response Plan. Specific Instruction Books may be drawn up for each participant (duty manager, tunnel operator, patrol team).
- **Intervention services:** all local services, public and private, including tunnel personnel, that may intervene in the event of an accident, including the police and/or *gendarmerie* and the emergency services.

- **Minimal operating requirements (MORs)** correspond to a threshold beneath which remedial measures are not sufficient to ensure safety. They refer to the minimum availability level of the safety equipment and personnel below which the tunnel must be closed to traffic.
- **Nominal operation:** operating conditions in which 100% of tunnel operating resources (personnel and equipment) are available.
- **ORSEC plan (civil security emergency plan):** as defined in Section III of the law on the modernisation of civil security (Law 2004-811 of 13 August 2004): “The organisation of rescue operations on a large scale or of a specific nature is defined, in each *département*, in each defence region and at sea, by a plan known as the ORSEC plan...”.
- **Rescue Operations Commander** (*Commandant des opérations de secours*, COS): The command organisation for emergency operations is determined by the general code for territorial institutions. The COS is under the authority of the rescue operations director (DOS, *Directeur des Opérations de Secours*) and is responsible for controlling all public and private resources deployed for rescue operations. In the event of imminent danger, the rescue operations commander takes necessary measures to protect the population and ensure the safety of the rescue personnel. He/she reports to the DOS.
- **Rescue Operations Director** (*Directeur des opérations de secours*, DOS): authority with administrative police powers. In this capacity the DOS defines the strategy for dealing with the incident and directs the rescue resources deployed.
- **Safety officer:** The European Directive requires a safety officer to be appointed for all tunnels over 500 m in length and located on the trans-European road network. The officer is responsible for coordinating preventive measures and safeguards aimed at ensuring the safety of users and tunnel staff.
- **Usual operating situation:** during normal operation, minor events may affect traffic without having significant effects on traffic flow. Likewise, minor equipment malfunctions may occur. These minor events or malfunctions result in simple interventions that are performed regularly and managed by the tunnel operating body or its usual subcontractors.
- **Usual operation:** operating conditions corresponding to a slight deviation from nominal operation, and not requiring any significant remedial measures. In this usual operating configuration, the only actions to be taken are preventive or curative maintenance.

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At the request of the CESTR (*Comité d'Évaluation de la Sécurité des Tunnels Routiers* / road tunnel safety assessment committee) which has now been superseded by the CNESOR (*Commission Nationale d'Évaluation de la Sécurité des Ouvrages Routiers* / national road structure safety assessment committee), the CETU (*Centre d'Études des Tunnels* / tunnel study centre) set up a working party to draw up a guide for all parties involved with road tunnel safety documentation. A sub-group, whose members are listed below, was set up to prepare this Emergency Response Plan booklet.

A list of those attending the meetings of the sub-group set up for the Emergency Response Plan booklet is given below:

Jean-Michel Vergnault (SETEC), Lieutenant Colonel Barat (DDSC), Philip Berger (Docalogic Inflow), Laure Stegmann (Bonnard et Gardel), Cécile Lacouture Tomas (Ligeron®), Eric Boisguerin (Scetauroute), Pierre Merand (Scetauroute), Véronique Aurand (Cetu), Michel Deffayet (Cetu), Nelson Gonçalves (Cetu), Didier Lacroix (Cetu), Jean-Claude Martin (Cetu),

Guide to Road Tunnel Safety Documentation:

- Booklet 0 Safety Documentation Objectives.
- Booklet 1 Practical method of compiling the safety documentation.
- Booklet 2 Tunnels in operation
“from the existing condition to the reference condition”.
- Booklet 3 Risks analyses related to dangerous goods transport.
- Booklet 4 Specific Hazard Investigations.
- ■ Booklet 5 **Emergency Response Plans.**

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An Emergency Response Plan aims to define how a tunnel operating body organises its staff and the tasks that are assigned to them in various situations that might affect human safety, as well as the methods for alerting outside emergency services and coordinating with them.

This booklet is designed to provide the parties concerned with the information they need to draw up an Emergency Response Plan.

At the request of the CESTR (Comité d'Évaluation de la Sécurité des Tunnels Routiers / road tunnel safety assessment committee), the CETU (Centre d'Études des Tunnels / tunnel study centre) set up a working party to put together this booklet.