

## **DISASTER MANAGEMENT REQUIRES A STRONG AND WELL-ESTABLISHED SAFETY CULTURE**

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### **ABSTRACT**

In most cases, large differences in pressure exist between the portals of long road tunnels as they often connect areas exhibiting different meteorological situations. While the forces resulting from the pressure gradient are taken into account in design and planning of new tunnels, problems may arise when existing tunnels require upgrading. In most cases such tunnels are ventilated by a transverse ventilation system or a system with massive point extraction. These requires an exact control of the air or smoke flow in the case of an emergency and hence an enormous technical effort to achieve the ventilation goals. This paper focuses on the problem of pressure gradients in long alpine tunnels, the technical solutions available, and on what needs to be considered when designing such installations in tunnels undergoing upgrading.

*Keywords: ventilation design, transverse ventilation system, long tunnels, pressure gradients*

### **INTRODUCTION**

In general, long road and rail tunnels often connect regions exhibiting different meteorological conditions. This is certainly the case where long mountain ridges are traversed, but is also common elsewhere. Pressure gradients have a large influence on ventilation design as they act as additional forces on the air column inside the tunnel.

#### **Summary:**

Everyone knows that instructions concerning an adequate reaction in emergencies are essential for all safety areas. For instance, an instruction manual, an alarm and emergency response plan, and brief usage instructions, among others, are required to guarantee an adequate response.

One of several paradoxes of the procedural rules is that they may encourage people to become command receivers and / or misuse them in order to avoid personal responsibility. These days, however, it is a well-known fact that disaster management requires flexibility, creativity, and above all the spirit of initiative, because disasters never follow a predictable scenario.

Another common problem is that usage instructions are static and thus not really suitable in terms of the selected approach to deal with unforeseen technical incidents / human behaviour. To put it in a nutshell, usage instructions can be an obstacle that stands in the way of efficient disaster management. It is sometimes necessary to choose between two evils and thereby even to disobey instructions in order to prevent a worse scenario from happening.

Usage instructions are indispensable but require a strong, stable, yet intuitive safety culture within the emergency services and tunnel management in order to enable the most effective disaster management.

## **1. PREVENTING DISASTERS**

Human errors and technical malfunctions are inevitable in a road tunnel. Our goal must be to prevent a catastrophic escalation of a primary event, even if a chain of unfortunate circumstances significantly worsened the initial situation. According to the author, to make this happen we need more than an alarm and emergency response plan or an instruction manual.

The nature of disasters is such that their spatial and temporal courses are not possible to predict. Their management requires flexibility, creativity, spirit of initiative, resolution and sense of responsibility among all employees of emergency services and tunnel management in addition to significant expertise.

### **Plans and instruction manual - an obstacle?**

In an organised, "proper" safety culture, there is always the risk that people will acquire a behaviour that sounds like this: "I follow the instructions and therefore I'm safe. I am relieving myself of any responsibility as I do only what the internal emergency plan tells me to do." Such conduct is extremely inappropriate when dealing with disasters, because, despite all the uncertainties with respect to big incidents in tunnels, one thing is clear: an efficient disaster management requires measures that are different from the ones we could anticipate beforehand.

The author believes that reducing the preventive operational planning is not an option and that plans and instruction manuals can only be interpreted as "help for self-help", since they contain no set-in-stone absolute truths for all those involved. Self-efficacy of disaster helpers is essential. This means that people have to be convinced that they can manage their mission using their own professional competence.

It takes confidence not only in yourself, but also in your colleagues, superiors, and the organisation.

## **2. THE FOCUS IS ON PEOPLE**

Too long have we tried to achieve safety through purely technical solutions, too little importance was attributed to the education and training of people, which are designed to prevent an incident in the tunnel from bringing about catastrophic consequences.

Technical competence is important and actually relatively easy to achieve, but influencing people in the right way is much harder. The real question is: "How do people handle the issue of safety and how deep is their understanding of the risks that go hand-in-hand with a tunnel incident?" It is also crucial how the staff of the emergency services cooperate with each other. In this context, we start talking about safety culture.

## **3. SAFETY CULTURE**

Safety culture is the way and manner in which an organisation deals with safety issues.

Standards, values, goals, interests and behaviours of all stakeholders reveal a certain, better or worse, safety culture.

Commonly, there are 5 types of safety cultures:

- **Emerging** → basic safety culture
- **Managing** → reactive safety culture
- **Involving** → planned safety culture
- **Cooperating** → proactive safety culture
- **Continually improving** → resilient, intuitional safety culture

#### 4. A BETTER SAFETY CULTURE WILL REQUIRE A TOP/DOWN APPROACH

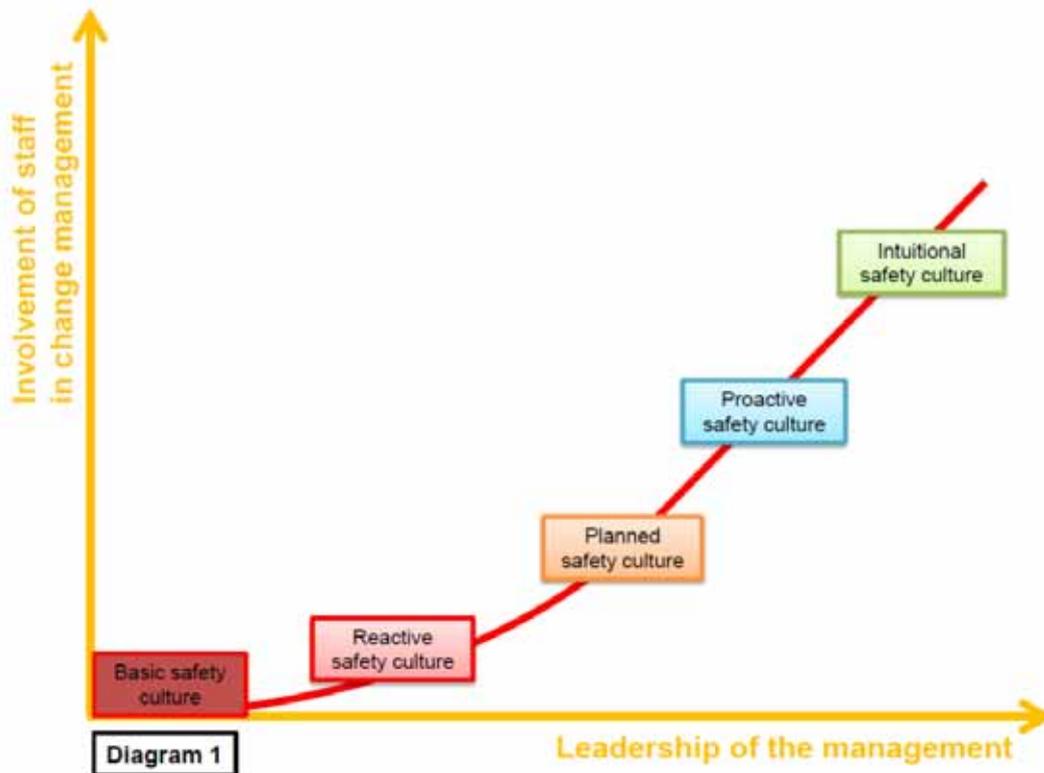
Changing the safety culture of an organisation is a lengthy and difficult process, which does not only affect the behaviour of its employees. The change has to start upstream, with personal values and beliefs. This will only become possible if the process of change will be given the highest priority at all levels of management. Change management is first of all a top/down approach, where the management tier leads by example.

Table 1 represents how management deals with the safety topic.

**Table 1:** Behaviour of the management within a specific safety culture.

	<b>Behaviour of the management</b>
basic safety culture	There is no need for action without legal provisions. We are not talking about the incident, and thereby we avoid problems.
reactive safety culture	Safety is guaranteed. If we come across a problem, we will act.
planned safety culture	We are very well organised, and we can deal with any situation.
proactive safety culture	We analyse all incidents, and we are always looking for ways to improve ourselves.
resilient, intuitional safety culture	I lead by example, I'm aware of my people's problems, I discuss their problems with them and encourage them to be proactive in all their safety concerns.

The change in the safety culture requires not only the leadership of the management, but also involvement of the staff, an open dialogue, and transparency within the organisation at all times (Diagram 1). Staff must be encouraged to take an interest in safety issues and also apply their knowledge in practice. It is crucial that everyone concerns themselves with workspaces and safety problems of others.



## 5. RESILIENT ORGANISATION

The issue of making the disaster management system work through a strong and well-established safety culture is inextricably linked with the issue of a "resilient organisation". What it essentially comes to is that an organisational structure (for example, a fire department) is established in such a way that in unfavourable conditions (e.g. a certain leader is not present, a task group is late, emergency personnel are faced with a technical breakdown, etc.) it proves to be resilient, acts quickly and efficiently.

A resilient organisation is only possible within a stable and strong safety culture and requires from its employees:

- an ability to have a realistic assessment of the situation through individual attention
- acceptance of the situation
- strong analytical capabilities
- willingness to take responsibility and independent capacity to act
- self-efficacy and self-confidence
- esprit de corps
- confidence in the support of the organisation
- ability to manage emotions
- creativity

This is a lengthy process that can only be achieved if the leadership of the management always stays in motion.