

An aerial photograph of a complex highway interchange with multiple overpasses and ramps. Overlaid on the image is a glowing digital globe composed of a network of white and blue lines, representing global connectivity. The text is centered over the globe.

PIARC GLOBAL ROAD SAFETY KNOWLEDGE EXCHANGE ROAD TUNNELS

PIARC TECHNICAL COMMITTEE ON TUNNELS

PIARC Technical Committee on Tunnels observes the construction and maintenance of tunnels. The primary purpose of the Tunnels Technical Committee is to develop best-practice approaches and successful solutions that will ensure the safe operation of heavily trafficked urban tunnels. The Tunnels Technical Committee and the Road Safety Committee work together on items related to the road safety in tunnels.

PIARC ROAD TUNNELS SAFETY

The construction and the maintenance of a tunnel are always a challenge, and their realization requires the use of techniques and tools that are increasingly sophisticated and complex. PIARC has responded to the need to bring together the experiences gained in the field of tunnel operations by addressing a range of issues related to the use of road tunnels, such as geometry, equipment and its maintenance, operation, safety, and the environment. PIARC has produced various reports, case studies, and documents available to all Road Authorities and Stakeholders. The PIARC Road Tunnels Manual groups together, summarizes and updates the vast amount of information contained in these various reports and articles.



Significant Incidents in Road Tunnels



Collisions, fires and releases of dangerous materials in road tunnels are incidents that require special attention, because they are, or have the potential to develop into, events with serious consequences. They can endanger people's health, or cause property, infrastructure or environmental damage. Their analysis is also fruitful for the examination of underlying core risk factors.

Road Tunnels Safety Issues

Incidents such as crashes in road tunnels may be no more frequent than those on the open road, as tunnels can provide a safer, more controlled driving environment for road users. However, the consequences of major incidents in the confined tunnel environment are potentially significantly more severe than on the open road and usually raise stronger reactions from the public.



Tunnels are enclosed structures with confined space that can cause, for some users, feelings of anxiety and particular behavior especially during a collision. Therefore, the proactive actions and reactions of those in charge of operating the road tunnels is a decisive factor in ensuring the safety of people during an incident.

Existing tunnels require specific approaches and tools to identify and evaluate the need for safety upgrade programs. Even where previous improvement programmes have been carried out, Existing tunnels may not be in line with the current safety standards because of subsequent regulation updates.

Human Factors for Tunnel Road Safety



Drivers need to be more aware of how they should behave in tunnels. A long stretch of road (150-200m) before the tunnel should not contain too many traffic signs or signals. The tunnel safety facilities should be easily recognizable even in normal traffic. Alarm signals should be provided by multiple-redundant sources (e.g. public address systems and variable message signs).

The proactive actions and reactions of those in charge of operating the road tunnels are decisive factors in ensuring the safety of people during an incident. Therefore, it is essential to organize consultation and cooperation during the tunnel design process and define measures necessary to minimize the time required to mobilize the emergency services.

Tunnel Road Safety Measures

A safe tunnel environment can only be achieved by an optimized and balanced interaction of all aspects influencing safety, including infrastructure, equipment, user behavior, operational practices, and emergency response procedures. In addition it is necessary to adopt measures preventing the occurrence of significant incidents, mitigating the consequences of the events, as well as measures supporting self-rescue and emergency.



A structured approach for assessing and preparing refurbishment programs for existing tunnels includes two tasks. The first task aims to assess the current situation of the tunnel to identify the current safety level. The second task aims to define the future situation after any upgrade or refurbishment works which should be acceptable in relation to the defined safety level goal.

Tunnel Road Safety Recommendations



It is important to adopt the integrated approach during the design of road tunnels. There is a need to establish the safety concept in an early design stage and provide it at all project stages. Risk assessment can be used to address the specific safety features of a tunnel system

and their impact on safety.

Specific and appropriate training is essential, as well as establishing proper protocols and post-crash intervention sequences. The design of tunnels and their operation should take account of human factors, as it should ensure that the measures implemented are likely to be well understood and adopted by the users.

Read More

- [PIARC ROAD TUNNELS MANUAL](#)
- [Technical report 2012 R23 "Current practice for risk evaluation for road tunnels"](#)
- [Technical report 2016 R35 "Experience with significant incidents in road tunnels"](#)
- [ROAD SAFETY IN TUNNELS](#)
- [Technical report 2016 R06 "Improving safety in road tunnels through real-time communication with users"](#)
- [Technical report 2008 R02 "Risk analysis for road tunnels"](#)
- [Technical report 2008 R17 "Human factors and road tunnel safety regarding users"](#)