
Strategic Theme 4: Resilient Infrastructure

Goal

The goal of Strategic Theme 4 is to improve the quality and efficiency of road infrastructure through the effective management of assets in accordance with user expectations and government requirements. TC 4.4 has been formed to focus on road tunnels within Theme 4.

Overview

This was the fifth meeting of the full Technical Committee and was held in-person at the Chartered Institution of Highways and Transportation office in London. The purpose of this TC 4.4 meeting was to present and discuss the main activities and products of the TC 4.4 Work Groups, discuss preparations for international seminars and conferences and agree the next meeting dates and venues.

14 June 2022

Mr Ingo Kaundinya (Chair of TC 4.4) opened the meeting and 22 members participated.

TC 4.4 has 71 full members and 17 Associate members. There are also 61 Associate members in our Work Groups.

Our Technical Committee was welcomed to London by Lila Tachtsi, Chair of PIARC UK, David Ogden, Vice Chair PIARC UK and Justin Ward PIARC UK.

Work Groups

Work Group 1 – Best Practices in Urban and Heavily Trafficked Tunnels

This Group is working on best practices in management (maintenance and traffic operations) in urban and heavily trafficked tunnels. It will prepare two outputs; a collection of case studies and a full report. The case studies report, published in April 2022, covers quick responses to incidents, measures to organize works and reduce disruption to users and new tools for maintenance and operation.

The full technical report will include the case studies and analysis of each case study leading to recommendations for traffic operation, maintenance, and refurbishment strategies. The technical report is expected to be completed in December-2022.

Work Group 2 – Tunnel Resilience

The Work Group is developing a report on increasing tunnel resilience with the aim of increasing the availability of tunnels, safely. The Group's literature review has been completed and a report published by the WRA in March 2021. The Group has prepared 18 case studies on tunnel resilience from 13 countries. (including one case study from Australia). The case studies together with the literature review, form a briefing note report, which was published in March 2022.

The Work Group is currently preparing a document to describe various measures that can be used to improve road tunnel resilience.

The measures to improve road tunnel resilience will be combined with the briefing note report to form the full technical report. A new chapter will be included in the full report to provide a roadmap to manage and improve road tunnel resilience. The full technical report is expected to be ready to submit to the PIARC General Secretariat in October – December 2022 for final review and approval to publish.

The definition of “resilience” adopted by the Work Group takes into consideration the output of Technical Committee 1.4, on climate change and resilience of road networks.

I am a member of this Work Group.

Work Group 3 – Intelligent Transport Systems in Tunnels

This Work Group is examining ITS developments for road network management and what could be applied in tunnels to improve safety and traffic flow efficiency. This Group is using surveys to obtain some of the information for its report.

The draft technical report has been delayed and is now expected to be submitted to PIARC General Secretariat in September 2022 for review and approval to publish.

Work Group 4 – Impact of New Propulsion Technologies

This Group is studying the impact of new propulsion technologies on road tunnel operations and safety and how to prevent and mitigate the potential consequences of incidents involving alternative fuel vehicles. A report based on the collection of case studies is expected to be published in 2022. A full technical report is being prepared and is expected to be ready to submit to PIARC General Secretariat in October 2022 for review and approval to publish.

The Work Group is continuing to request committee members for details of incidents involving alternatively fueled vehicles and policy information regarding the treatment of alternatively fueled vehicles.

Task Force – International Conference

A Task Force has been established to prepare and run the 2nd international road tunnels conference. The theme of the conference is road tunnel operations and safety. The conference will be held 25 – 28 October 2022 in Granada, Spain. Over 160 abstracts have been submitted for possible acceptance to prepare and present a paper at the conference. The conference is expected to attract approximately 800 participants. A technical tour will be part of the conference and participants will have the option of visiting the Calle 30 tunnels or the A-7 tunnels.

Task Force – DGQRAM

DG-QRAM is software that is used to classify tunnels for use by particular dangerous goods vehicles. In the current cycle, the software has been further upgraded to better meet user’s needs. A meeting on 20 June will decide who will test the improved tool, how to disseminate the tool and what to include in training materials. The upgraded tool is expected to be ready for use in early 2023. Further modules could be developed for DGQRAM, but further funding is required. A paper on DGQRAM will be presented at the international road tunnel conference in Granada.

Task Force – Knowledge Management

This Task Force continues to progressively update the manual. Case study reports prepared by the Work Groups will be included in the appropriate sections of the manual.

International Seminars in Developing or Transition Countries

The Technical Committee recently conducted a seminar in Colombia. There were several hundred participants, and the committee received much praise for the quality of its presentations.

The committee has been invited to conduct a road tunnels seminar in Delhi/Dehradun, India in April 2023. The main topic of the seminar is advances in design, construction and operation of tunnels. An organising committee for this seminar will be established to finalise topics and speakers by October 2022. The Technical Committee will hold its meeting on 18 & 19 April 2023, with the seminar following immediately on 20 – 22 April. A technical tour of the Silkyara tunnel will be included in the seminar program.

World Winter Service and Road Resilience Congress – Calgary

This Congress was held in Calgary, Canada in February 2022. Four members of the Technical Committee attended to make presentations, which were all well received. All committees that have an interest in resilience met to discuss their work. A short summary report of this meeting has been prepared for the PIARC General Secretariat.

15 June 2022

World Road Congress 2023 – Prague

Our Technical Committee is invited to make two presentations.

Topic 47- Digitisation of road tunnel design and management.

Topic 48 – Road tunnel operation and safety issues related to the usage of new energy carriers in road vehicles.

A call for papers for the Congress commenced in May 2022.

Review of abstracts by our Technical Committee in Sept/Oct 2022.

Review of full papers by our Technical Committee in Feb-April 2023.

We expect our Technical Committee will have three hours of content to present on:

- Reports from each of our four Work Groups
- Possibly present on DGQRAM
- A paper prepared on road tunnels by an author from outside our Technical Committee

Liaison with other organisations

ITA and ITA-Cosuf

The research group of ITA-Cosuf works closely with PIARC.

Within these organisations there is an Activity Group of Road Tunnel Safety Officers.

Their next meeting is in June 2022.

CIE-International Commission on Illumination

Only one committee of this organisation is currently active, This is the committee dealing with tunnel lighting evolution.

It is revising CIE 88: 2004, Guide for the lighting of road tunnels and underpasses.

Preparations for 2nd International Road Tunnels Conference

This conference will be held in Granada, Spain on 25 – 28 October 2022.

Main objective is to promote the latest knowledge on road tunnel operations. It will be hosted by PIARC and ATC (Spanish National Tunnels Committee).

The program comprises of eight main topics with many presentations to be made by our Technical Committee members.

Expect approximately 800 participants to the conference.

Our Technical Committee meeting will be held on 23 & 24 October, immediately prior to the conference.

Potential Topics for the Next Cycle

We discussed possible topics for the next cycle of the Road Tunnels Committee. We considered the following topics to be worthy contenders and will be submitted to PIARC for consideration.

- Road tunnel operations and safety issues related to the usage of new energy carriers in road vehicles. Consider collecting data relating to incidents. Currently, relatively little is known about the frequency and nature of incidents.
Possibly prepare advice for first responders.
- ITS in tunnels. Consider preparing a briefing note to provide an update on developments.
- Sustainable tunnels.
Decarbonisation of tunnel construction, maintenance and operation.
Energy efficiency.
Use of prefabrication techniques.
Use of innovative materials.
Increase of tunnel equipment and tunnel system lifecycle.
Condition monitoring of tunnel equipment.
- Further development of DGQRAM.
- Continuous update of the Road Tunnels Manual.
- Digitisation of road tunnel design and management. Application of artificial intelligence. Live monitoring of operations.
- Consider setting up a Task Force to review PIARC reports relating to road tunnels and decide which reports to retire because they are outdated.

Technical Presentations

Fire in the Northern Link Tunnel, Stockholm

On 17 March 2022, there was a fire in the Northern Link tunnel in Stockholm. It was initiated by a nose to tail crash involving an electric vehicle. On average, there is one fire a year in this tunnel. The tunnel is fitted with a Fixed Fire Firefighting System (FFFS). The fire was extinguished in a relatively short time, but it later re-ignited. Investigations indicate that without the FFFS flames would have reached the tunnel ceiling. The predicated flame height is attributed to the fire load not because of the involvement of an electric vehicle. A key takeaway for us is that Technical Committee members are supportive of FFFS. I understand that this system is typically used in road tunnels in Australia and New Zealand.

Use of iTwin

A Technical Committee member who is employed by WSP gave us a presentation on the use of iTwin which is used for design collaboration by design team teams of various design disciplines, and to support continuous assurance. iTwin does not have the ability to capture significant detailed design as BIM, but a key benefit is that it can run on any basic computer. Drones are beginning to be used to gather data to formulate a 3D model.

Developments in road tunnel systems in South Korea

We learned that in South Korea, portable fire extinguishers are periodically checked manually. South Korea has recently developed a system which enables portable fire extinguishers to be monitored remotely using a digital system.

A battery powered system for jet fans is being trialed. The energy created by fan blades turned by the piston effect in tunnels is being harnessed and returned to the battery. Estimated savings of approximately \$100k per year per tunnel (tunnel length in the range of 500m – 1km).

UK Research Work

Equipment has been developed to generate smoke and undertake various simulations in a tunnel. The equipment is trailer mounted and can generate the equivalent of up to 5 MW fires, in a safe and controlled way. The smoke is non-toxic. Each test takes approximately 10-12 minutes to conduct. The tests can be used to examine the effects of ventilation fans, performance of fire detection systems and the behaviour of fire evacuees.

16 June 2022

A technical tour to ventilation facilities and control room of the Queensway Tunnel in Liverpool.

Next Meetings

At this time, we have planned the following meetings of the Technical Committee:

October 2022: 2nd International Tunnels Conference and TC meeting in Granada, Spain

April 2023: Seminar in Delhi/Dehradun, India and TC meeting.

Late 2023: Prague, Czech Republic – World Road Congress.

George Mavroyeni
Technical Director, Independent Reviewer
AECOM Australia Pty Ltd
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