

ICT-based Tunnel Safety Seminar Day

23 November 2023

09:00-15:45

Introduction

Recent years have seen the emergence of several innovation fields within the area of Information and Communication Technologies (ICT) – e.g., from Artificial Intelligence (AI), 5G cellular and vehicular communication networks, to sensor fusion, big data processing and storage, and automation. This has in part enabled and coincided with the emergence of Autonomous Vehicles (AVs) and smart roads paving the way for the deployment of Cooperative Intelligent Transport Systems (C-ITS) on the road system. On the other hand, **road tunnels** constitute a vital part of the road system, particularly in countries such as Norway where geographical terrain mandate the presence of many tunnels. In this seminar day we will discuss in detail how these technologies can contribute to ensuring the increased safety in road tunnels.

Presenters

- Naeem Khademi (Associate Professor, UiS -- main organizer)
- Geir Sverre Braut (Professor, SUS)
- Gunnar Jenssen (SINTEF)

Agenda

Time	Topics	Presenter
09:00–09:15	Opening seminar day	Naeem Khademi
09:15–10:00	Risk Management and Regulation in Road Tunnels (part #1) <ul style="list-style-type: none">• The concept of risk<ul style="list-style-type: none">○ Risk as a “construct”○ Describing and analyzing risk• Risk regulation<ul style="list-style-type: none">○ Models○ Mechanisms (tools)○ Responsibilities	Geir Sverre Braut
10:00–10:15	Break	--
10:15–11:00	Risk Management and Regulation in Road Tunnels (part #2) <ul style="list-style-type: none">• General principles for risk management<ul style="list-style-type: none">○ Design-phase versus operating-phase○ “High risk”-approaches○ “Population”/” Mass-strategic”-approaches• Processes for (organizational) learning<ul style="list-style-type: none">○ From analyses○ From incidents○ From exercises	Geir Sverre Braut
11:00–11:15	Break	--
11:15–12:00	Human Behavior in Normal Situations and in Tunnel Fires (part #1) <ul style="list-style-type: none">• Tunnels: key factors affecting tunnel safety and human behavior• Evac modelling	Gunnar Jenssen

	<ul style="list-style-type: none"> ○ Normative versus formative behavior ○ Can modelling be trusted? ● What can we learn from real tunnel fires? <ul style="list-style-type: none"> ○ Interview of survivors in real <i>Oslofjord & Gudvanga</i> Tunnel fires ● Theories of Human behavior in tunnel fires <ul style="list-style-type: none"> ○ Freeze response ○ Fight or Flight? 	
12:00—13:00	Lunch Break	--
13:00—13:45	Human Behavior in Normal Situations and in Tunnel Fires (part #2) <ul style="list-style-type: none"> ● Technologies and emergency exit systems ● Detection and warning <ul style="list-style-type: none"> ○ The role of AID and CCAM in self-rescue ○ Technologies and emergency exit systems ● Studies of way finding in tunnel fires <ul style="list-style-type: none"> ○ Use of emergency escape tunnels and evacuation rooms ○ EU regulations ○ Exemptions ○ Recommendations 	Gunnar Jenssen
13:45—14:00	Break	--
14:00—14:45	C-ITS and Communication Technologies in the Road Tunnels (part #1) <ul style="list-style-type: none"> ● Vehicular communication in road tunnels <ul style="list-style-type: none"> ○ Technologies: DSRC/WAVE and C-V2X ○ Concepts: V2X concepts (V2V, V2I and V2P) ○ Standards (ETSI and 3GPP) ● C-ITS messaging and protocol stack <ul style="list-style-type: none"> ○ C-ITS messages for safety in road tunnels 	Naeem Khademi
14:45—15:30	C-ITS and Communication Technologies in the Road Tunnels (part #2) <ul style="list-style-type: none"> ● GNSS-denied Positioning in road tunnels <ul style="list-style-type: none"> ○ Infrastructure-based Solutions (LTE-P, BLE beacons) ○ Deployment Challenges ○ Potential non-infrastructure-based solutions (AI-based, RFIC/visual tags) ● Safety applications in road tunnels <ul style="list-style-type: none"> ○ Use of edge computing ● Risk-aware Decision Support Systems (DSS) for and C-ITS messaging using V2X ● Digital twins for tunnels in operation and traffic monitoring centers 	Naeem Khademi
15:30—15:45	Concluding remarks and wrapping-up	Naeem Khademi