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Risk and incidents assessment in Slovak road tunnels

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Abstract

Tunnels are specific engineering structures, which are constructed in order to shorten transport routes and improve road safety. Therefore, safe operation of tunnel is very important. Tunnel Traffic & Operation Simulator of the University of Žilina in combination with unique softwares allows a research of the possible operating conditions during a normal service and model emergency situations. Risk analysis of road tunnels is in Slovakia managed by technical specifications TP 041 (TP 02/2011) „Risk analysis for Slovak road tunnels“ where is defined precise methodology of risk analysis with regard to safety of road tunnels users. This technical specifications, based on the Austrian tunnel risk analysis model TuRisMo, defines and explains exactly a risk model to calculate risk in road tunnels.

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1. Tunnel Traffic & Operation Simulator

University of Žilina – Faculty of Civil Engineering dispose of the Tunnel Traffic & Operation Simulator, realized as a real operator’s workplace. It shows virtual 1 km long highway two-tube tunnel [1]. The main objectives of the simulator are to test a possibility of different scenarios in tunnel, to increase transport’s safety in road tunnels, to create prediction models, to collect and process data from tunnels operation, risk analysis and a new knowledge attainment for new tunnels project.

Thanks to this research site it is possible to verify operating conditions by real operation at the visualization on each operating condition. Verification of operators’ response in operating conditions in the tunnel tube, also

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throughout a formation of fire, is possible only on the Tunnel Traffic & Operation Simulator in the Transport Research Centre. In the case of operating condition with dangerous goods transportations vehicles it is very necessary and required by the TP 082 a preventive verifying of operators professional competence.

Basic composition of the Simulator consists from 3 parts:

- Central Control System (CCS) – part of automatic tunnel equipment control,
- Manual Control Module (MCM) – part of manual control as separated module, it serves to a manual tunnel operation in the case of the central control system's accident
- Software for Prediction of Phenomena (EMUT) - evidence of tunnel incidents.

2. Expected development of technological equipment of tunnels

Slovakia is currently working on centralizing of control operator workstations of tunnels. It means that we will supervise several tunnels in one region from one place. So it is very important to unite all elements related to this issue – technical solutions, terminology, visualization, etc. Technical solutions and technological equipment of tunnels is carried out by TP 093 – Central control system and visualization - tunnels. Visualization of individual elements and complete solution of entire Central control system must be created in every tunnel's control center according to Tunnel Traffic & Operation Simulator used for the calculation of risk analysis of Slovak road tunnels. Technical solution of new tunnels will be corresponding to the reference tunnel (Tunnel Traffic & Operation Simulator) and operators must be regularly trained on the Simulator because they will work with the same system.

3. Risk analysis

The risk analysis of road tunnels in Slovakia is performed according to specifications TP 041 “Risk analysis for Slovak road tunnels”. This regulation was created firstly to the definition of the exact methodology for risk analysis of the safety of road tunnels users. For the calculation of risks in road tunnels is in TP precisely defined and explained the risk model, which was developed based on the Austrian model for risk analysis of tunnel TuRisMo [4].

Table 1. Overview of the Slovak tunnels in use [2].

	Šibenik	Bôrik	Sitina	Horelica	Branisko
Tunnel's length	588 m	995 m	1 440 m	605 m	4 975 m
Number of tunnel tubes	2	2	2	1	1
Category	2T 8.0	T 7.5	T 7.5	T 9.0	T 7.5
Route	Jánovce - Jablonov	Mengusovce – Poprad, západ	BA, Polianky – BA, Mlynská dolina	Oščadnica – Čadca, Bukov	Beharovce – Široké
Start of construction	06/2012	06/2006	10/2003	04/1998	05/1997
Used since	11/2015	12/2009	06/2007	10/2004	06/2003
Traffic load	13 573 veh/24h	12 342 veh/24h	50 351 veh/24h	13 011 veh/24h	9 433 veh/24h
The proportion of passenger vehicles	75.00 %	80.13 %	87.90 %	68.96 %	75.24 %
The proportion of trucks	23.08 %	18.21 %	11.41 %	30.52 %	23.14 %
The proportion of bus	1.95 %	1.66 %	0.69 %	0.52 %	1.62 %

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