

**Nordic research
and development
of traffic and road
systems**

Tunnel Safety

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TRAFIKVERKET
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Evaluation of EU projects on road tunnel safety

- Why
- Scope
- How
- Outcome
- Next step



TRAFIKVERKET



Statens vegvesen



Vejdirektoratet

Liikennevirasto



NordFoU

- Conclusions!

Background for the project

- Disastrous fires in European tunnels, from 1999 -
- Tunnel safety, an important part of the EU White Paper on Traffic Safety 2001
- EU directive in 2004 on minimum safety requirements for tunnels
- EU research projects to improve the general knowledge on tunnel safety;
 - report pages: 12 000
 - cost: 40 000 000 €

Background for the project

In the EU tunnel safety R&D projects

- only a few researchers from the Nordic countries were active
- the Nordic road authorities had not been very active in the projects.

We focussed a challenge:

- How to learn, benefit and make use of these new findings?

The Nordic Road Association and its technical committee on Tunnels has been very successful in producing guidelines, arranging seminars and in the exchange of knowledge and experiences.

Thus, we came up to an unanimous decision:

- use the Nordic platform!

Scope of the project

- Analysis and evaluation of results from the EU-sponsored R&D projects concerning Safety in Road Tunnels
- To identify and prioritise topics where it is beneficial to formulate proposals for common Nordic guidelines, manuals and new research projects
- The result could be a basis for establishing "best practice" for owners, authorities, designers and consultants with respect to questions concerning:
 - Safety levels, structural assumptions and conditions,
 - Feasible technical solutions,
 - Strategies for operation, monitoring, traffic management and maintenance

How the project was performed

Steering Group	Harald Buvik, Statens vegvesen, Norway Pauli Velhonoja, Vägförvaltningen/Tiehallinto, Finland Gisli Eiriksson, Vegagerdin, Iceland Carsten Henriksen, Vejdirektoratet, Denmark Bernt Freiholtz, Vägverket/Trafikverket, Sweden
Administrating organisation and project leader	Swedish Road Administration/ Swedish Transport Administration Matti Huuskonen
Consultants	Kristian Appel, Traficon Ltd, Finland Niels Peter Høj, Høj Consulting, Switzerland Haukur Ingason, SP, Sweden Kristen Opstad, Petrell, Norway Yngve Anderberg, F&SD International, Sweden

The nine EU-projects reviewed:

UPTUN	Upgrading fire safety of existing tunnels
SafeT	European Thematic Network Safety in Tunnels
DARTS	Durable and Reliable Tunnel Structures
FIT	Fire in Tunnels
SIRTAKI	Safety Improvement in Road & Rail Tunnels using Advanced ICT and Knowledge Intensive DSS
VIRTUAL FIRES	Virtual Real Time Fire Emergency Simulator
SAFE TUNNEL	Innovative systems and frameworks for enhancing of traffic safety in road tunnels
ERS2	QRAM Quantitative Risk Assessment Model for evaluation of dangerous goods transport through road tunnels was developed by PIARC and OECD as a part of the ERS2 project
STOA	European Parliament Study Assessment of the Safety of Tunnels (IP/A/STOA/FWC/2005-28/SC22/29)”

Outcome; focus areas

1. Fire safety	a) Design scenarios	Personal safety Ventilation Fire curves Detection
	b) Detection and active systems	
	c) Passive systems	
2. Road user safety	a) Traffic management	
	b) Risk management	
	c) Human response	
3. Structural safety	a) Accidental loads	Fire (explosion) Traffic (collision)
	b) Design of concrete structures (incl. equipment)	Fire incl. spalling, Dynamic load
4. Operation	a) Traffic monitoring and control	TIC/VTs
	b) Education / tests / collaboration	
	c) Traffic Management Systems	

The specific Nordic conditions?

It was investigated whether conclusions could be drawn for particular Nordic tunnel conditions, deviating from other European tunnel countries.

However, it was concluded as part of the review of the results of the nine EU projects that:

The modern Nordic tunnels demonstrate a large variety and no typical Nordic tunnel can be identified.

The results, which are important and relevant for other European tunnels are also important and relevant for Nordic conditions.

The NordFOU report gives:

- A review and a brief summary of each of the nine projects
- A compilation of relevant results within the focus areas
- Prioritised recommendations for future work.

Collect and read the full report from the
NordFOU web page;

http://www.nordfou.org/english/resultater_eng.html#p5

Next step: the second NordFOU tunnel project

Nordic harmonization of *Egress from tunnels in case of fire or other incident*

Self-evacuation

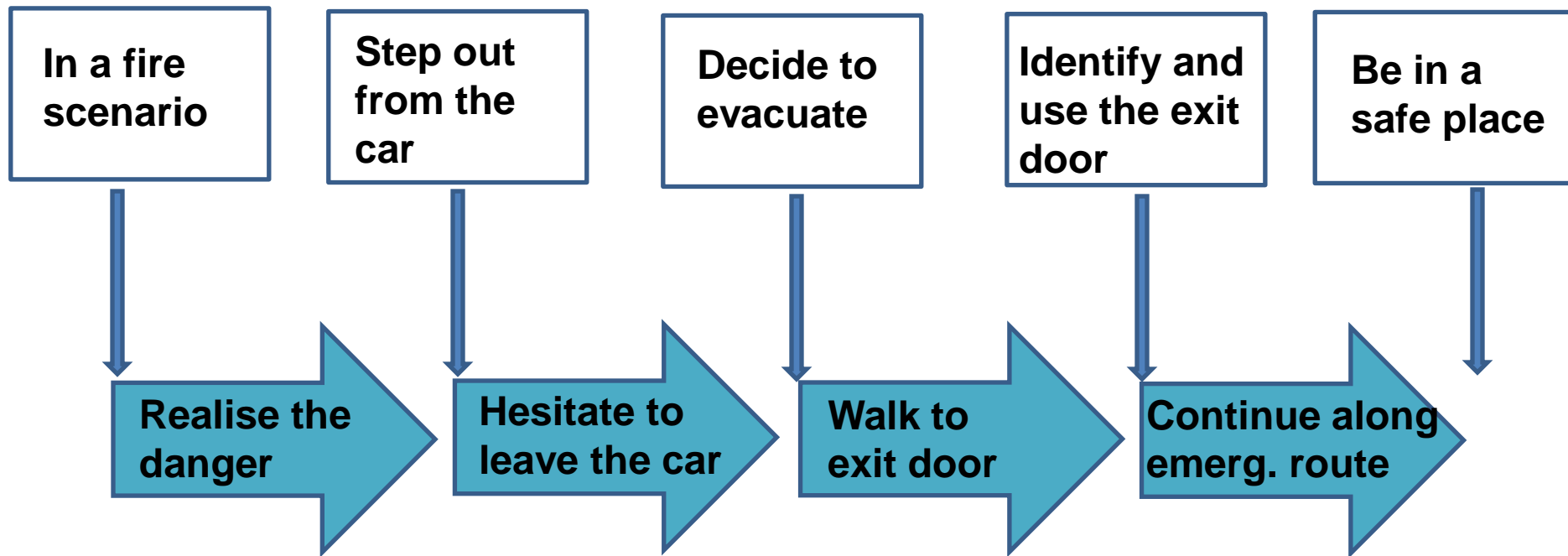
- Updated knowledge on human behaviour in tunnels
- The tunnel and the safety installations
- Traffic Control Centre

Next step: the second NordFOU tunnel project

Nordic harmonization of *Egress from tunnels in case of fire or other incident*

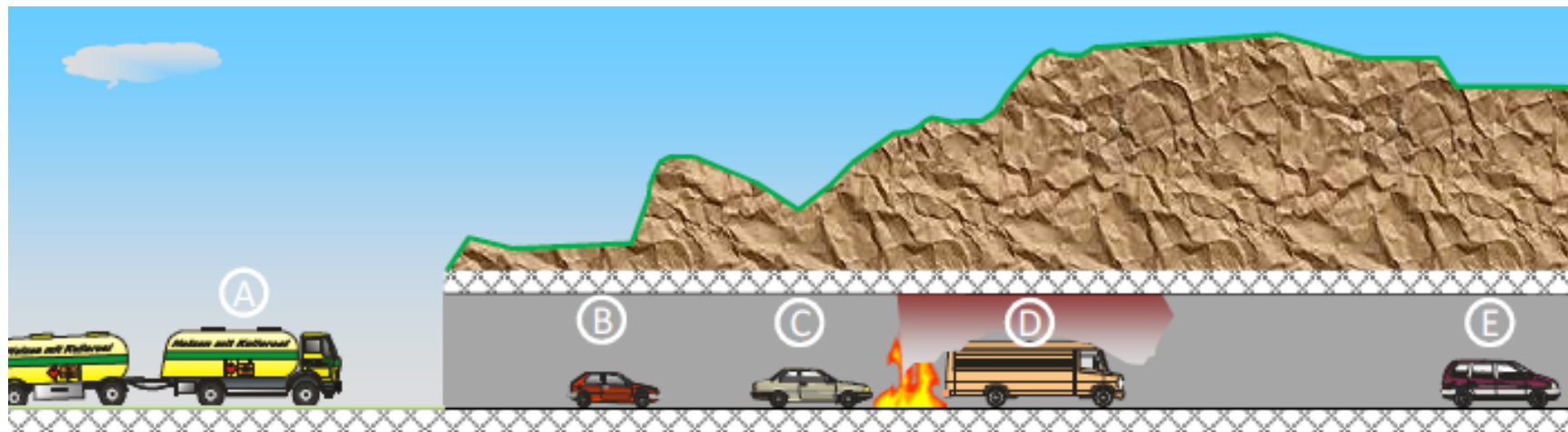
- Tunnels with high traffic (>AADT 4000/lane)
- Aspects: drivers position in relation to the core of the incident and the development of the scenario
- Experience and current practice in the Nordic countries
- Current Nordic and European guidelines
- Pamphlets to learn the tunnel users of best behaviour.

The different phases of the egress



Best action?

Depends on where you are!



- A) Endnu ikke kørt ind i tunnelen
Has not yet entered the tunnel
- B) Er i tunnelen og kører hen mod branden
Is in the tunnel approaching the fire
- C) Er ved branden og kan ikke køre videre
Near the fire and cannot continue driving
- D) Er ved branden og kunne køre videre
Near the fire but can drive on
- E) Er væk fra branden og kan køre ud af tunnelen
Is beyond the fire and can drive out of the tunnel

Conclusions:

In traditional collaborative fora, it is difficult to implement projects involving detailed studies;

→ NordFOU opens up for new options

We have learnt to effectively performed a Nordic project and also with a great success

We have spread information about and synthesis of knowledge from the EU's tunnel safety research to all Nordic stakeholders

Very cost-effective way to monitor and guide the development of the highly complex modern road tunnels

Strengthens the Nordic countries' abilities to influence the international aspects of tunneling technology.

Conclusions:

The Steering Group must be active and plan for a continuous monitoring and participating in the project

The Steering Group is the link to the country's various stakeholders;

- bring your own and others' knowledge into the project and other relevant national experiences
- ensure that the results reach all stakeholders

Project administration will be more extensive than for a similar national project;

- proceed with the model; one country runs the entire project
- diminish the administrative work; NordFOU gives summarized information and more detailed information is given nationally. Rely on simple process descriptions and templates
- language: Summary in SE or DK or NO + FI + EN. Report written in EN or DK or SE or NO. For appendices: also DE or FR

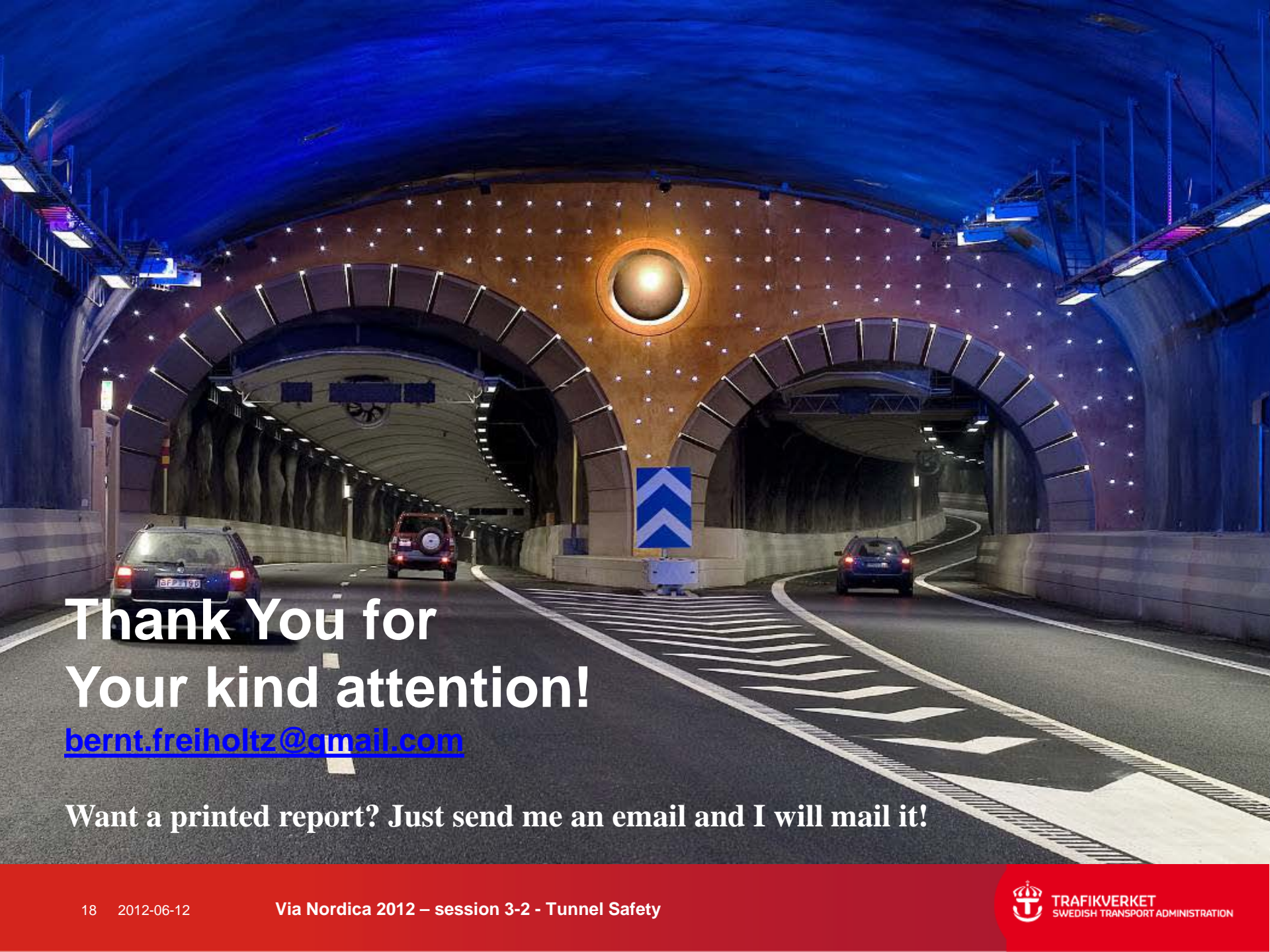
How to deal with "cultural differences", do we have any?

Risk factor; road authorities do not have sufficient amount of working hours for the delegates in the Steering Group.

Final Conclusions and Recommendations:

The NordFOU cooperation is a very powerful tool for us:

- Very cost-effective
- Broadens our own knowledge in the technical field
- Gives a better understanding of other ways of solving technical challenges
- Widens our networks and knowledge of how the market works
- Gives the result a higher probability of acceptance by the Nordic citizens
- Strengthens our arguments and positions on the international arena.



**Thank You for
Your kind attention!**

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