



2nd European Forum of Road Tunnel Safety Officers

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**How to define a
continuous process
to improve safety?**

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How to define a continuous process to improve safety?

Contents:

- Background in Sweden
- The tunnel safety process
- Tasks and noteworthy issues for the Safety Officer
- Safety process, example from the Northern Link Tunnel in Stockholm
- Conclusions



Swedish road tunnels:

30 tunnels in total

Under the implemented directive:

One tunnel in operation

One tunnel in construction

Two tunnels in the design phase

Swedish road tunnel regulations and handbooks;

The ITA-COSUF "*Updated survey of existing regulations and recognised recommendations*" provides more information

Look at www.ita-aites.org;

PATH: [ITA-AITES - Home](#) >> [Activities](#) >> [Committees](#) >> [Operational Safety](#)



Responsibilities in Sweden

Administrative Authority incl. the national regulatory tasks

The Swedish Transport Agency

Tunnel Manager

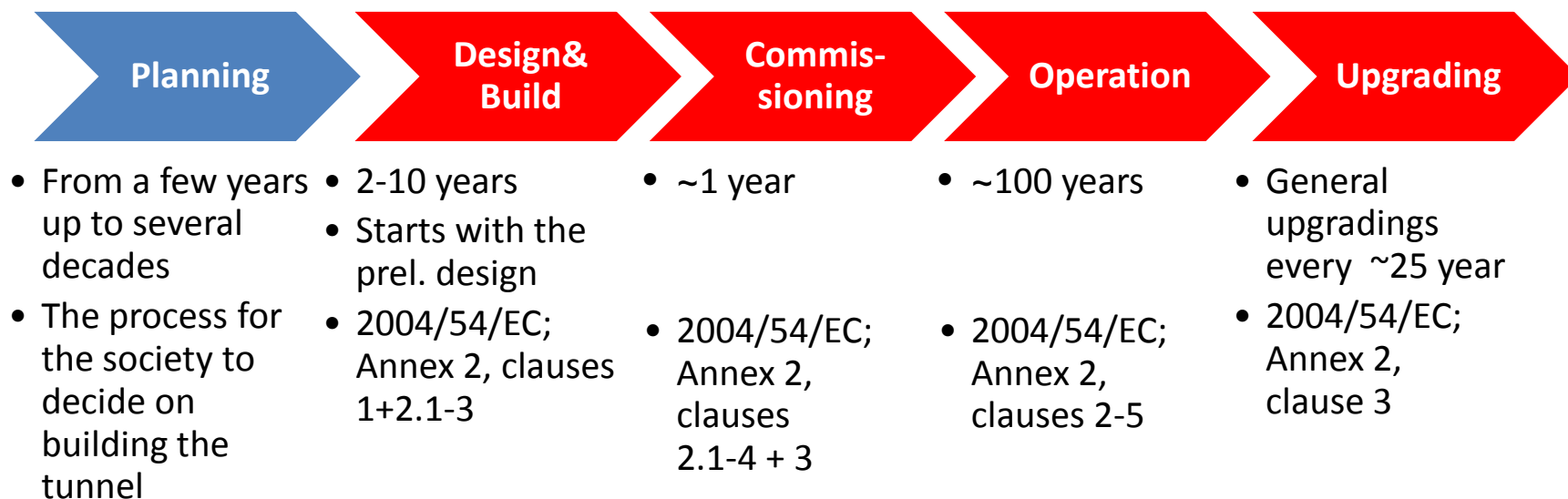
- **State roads:** the Swedish Transport Administration
- **Municipal roads:** the Municipality,
(the tunnel owner by the Planning and Building Act)
- **Other roads:** Tunnel Manager will be appointed by the AA

Safety officer

A national function in the Swedish Transport Administration.

“Säkerhetssamordnare” (= safety coordinator)

The phases and time spans for a tunnel/project



important for the SO to..

- Be aware of the different interests of the main stakeholders
- The SO key role to create win-win situations for all the stakeholders
- And by this be a leader for an educational process of all stakeholders for better understanding of tunnel safety.

The Safety Officers duties in the tunnel process

Prel. Design	Construction	Commiss	Operation	Change of constr./ operation	Sustantial modif.
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- **SO** appointment
- coordinate all ...measures to ensure the safety of users and operational staff
- give opinion on the safety documentation
- keep a copy of the safety documentation
- take part in the def. of safety schemes and the spec. of the struct., equipm. and operation
- give advice on the commissioning of the structure, equipment and operation of tunnels
- take part in the preparation of operational schemes
- ensure coordination with emergency services + take part in the planning, implementation and evaluation of emergency operations
- verify that operational staff and emergency services are trained.
- verify that the tunnel structure and equipment are maintained and repaired;
- take part in the evaluation of any significant incident or accident
- take part in the organisation of exercises + cooperate with TM and ES to organise joint exercises + together with ES evaluate exercises, draw up a report and make proposals

....all measures to ensure the safety of users and operational staff...

....opinion on the safety documentation ...

WHAT SAFETY LEVEL TO ACHIEVE?

Safety measures to be implemented in a tunnel shall be based on a systematic consideration of all aspects of the system composed of the infrastructure, operation, users and vehicles. The following parameters shall be taken into account:

- tunnel length,
- number of tubes,
- number of lanes,
- cross-sectional geometry,
- vertical and horizontal alignment,
- type of construction,
- uni-directional or bi-directional traffic,
- traffic volume per tube (including its time distribution),
- risk of congestion (daily or seasonal),
- access time for the emergency services,
- presence and percentage of heavy goods vehicles,
- presence, percentage and type of dangerous goods traffic,
- characteristics of the access roads,
- lane width,
- speed considerations,
- geographical and meteorological environment.



....all measures to ensure the safety of users and operational staff...

....opinion on the safety documentation ...

- Check and comment the detailed requirements of the directive incl. mainly the Annex 1
 - Fairly straightforward procedure!
- Give an opinion on the proposed safety scheme based on the 16 general parameters
 - Not an easy task!
 - But for some parameters risk analyses exist
 - Use your expert knowledge



To understand the road tunnel safety process:

- Try to find a holistic view
- Be an expert on the national regulations and guidelines on road tunnel safety
- Inform you on other safety regulations; Dangerous Goods, road infrastructure safety management, health&safety, environment, construction safety, civil protection and security
- Learn the process for Planning & Building in your country
- Read the relevant international documents on road tunnel safety :
 - ITA-COSUF "*Updated survey of existing regulations and recognised recommendations*"
 - PIARC reports *Integrated approach to road tunnel safety, Tools for road tunnel safety management and Human factors and road tunnel safety regarding users*
- Use the PIARC *Road Tunnels Manual* for finding the answers on your safety issues!

Safety process, example:

from the Northern Link Tunnel Project in Stockholm

Norra länken,
in construction

Essingeleden,
opened 1967

Södra Länken,
opened 2004

Österleden,
later



EXPERIENCES FROM THE FIRST YEARS OF OPERATION OF THE SOUTHERN LINK TUNNEL

- A huge traffic increase
- Frequent queues

An HGV fire in 2008:

- The fire detection system and ventilation and barrier control systems did not work properly
- The messages given were not well understood by the drivers
- Still, there were an overall good safety margin and properly handling from the Control Centre and by the Road Assistance Team.

Exempel på ett säkerhetskoncepts ingående delar

Utrymningsvägar ■ Utrymningsmarkeringar ■ Roterande utrymningsljus ■ Handbrandsläckare ■ Släckvattenförsörjning
Brandgasventilation ■ Nödbelysning ■ Högtalare i räddningsrum ■ Brandkårsradio ■ Hjälptelefoner ■ FM-Radio inbrytning
Tunnelinformationsskyltar ■ Mobiltelekommunikation ■ TV-kameror ■ Bommar ■ Variabla vägvisningar ■ Körfältsignaler
Vägtrafikcentral ■ Detektorer för brand, luft och stillastående fordon

And for the Northern Link Tunnel?

Longitudinal ventilation not good
in congested traffic conditions.
Improve emergency messages.



Revise the NLT safety concept!



A safety updating process for the NLT (in the construction phase), based on new information from the SLT

Four task groups update the design documents by amending the functional requirements for Traffic control; Fire detection, Alerting users and Fire suppression system

The alternatives are discussed in a scenario exercise/ seminar .

The NLT High Level Advisory Group together with the Emergency Services elaborate 12 possible safety upgradings

Additional safety measures:

Traffic control; ramp access control and fast queue elimination (use of hard shoulder and bus lane)

Fire detection system (in 1-2 min detect a fast growing fire 0,5 MW at 6 m/s)

Improving the messages for alerting tunnel users; evacuation completed after 4 min.

Fire suppression system to

- Prevent fire from spreading to other vehicles
- Diminish the fire development (the ES will extinguish the fire)



**Fire size
(MW)**

**Evacuation (in
congested traffic)**

**Property
damages**

**Disturbed
traffice flow**

1

Untroubled

None

Hours

5

Discomforted

10

Disturbed

Days

15

Critical

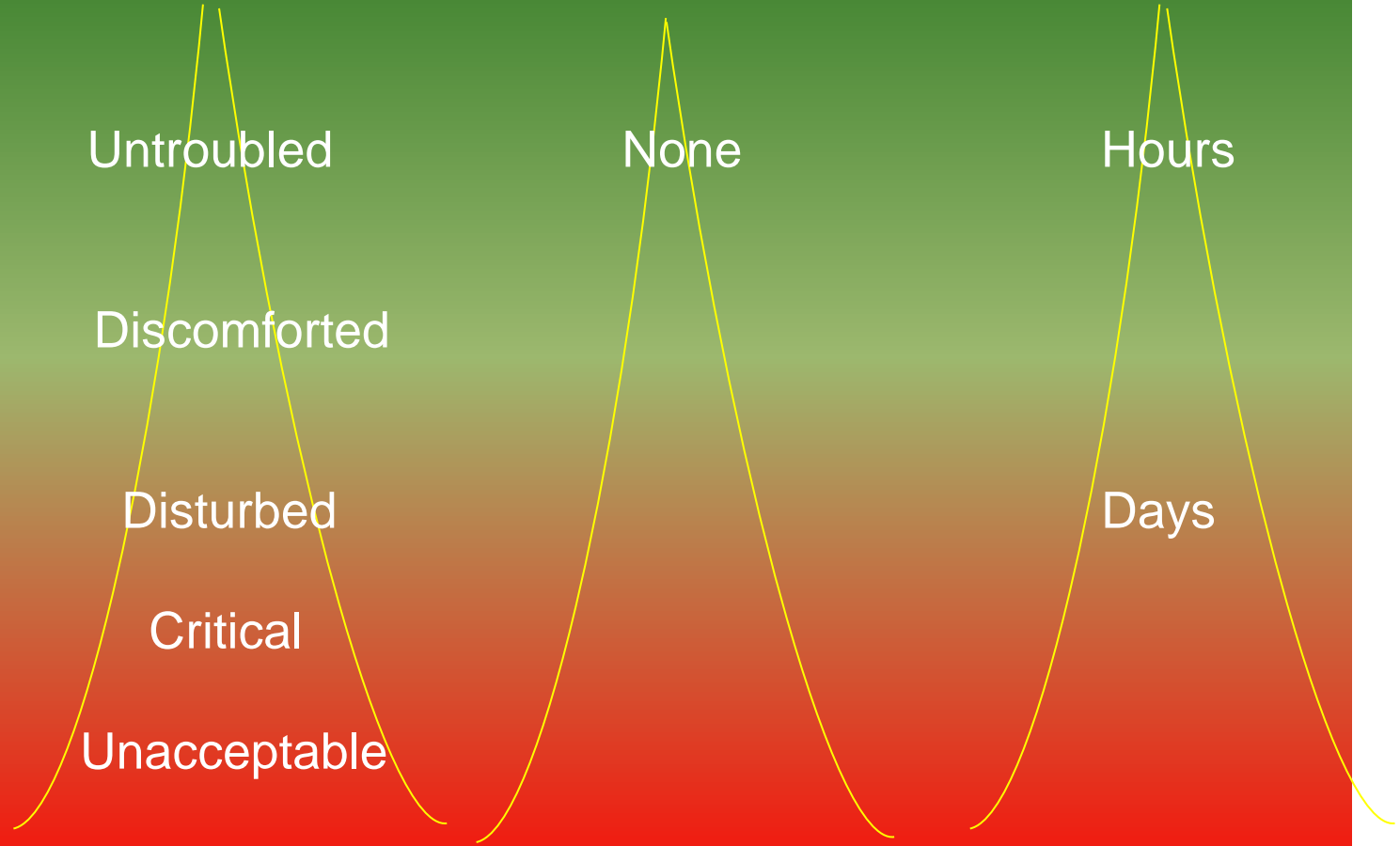
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Unacceptable

25

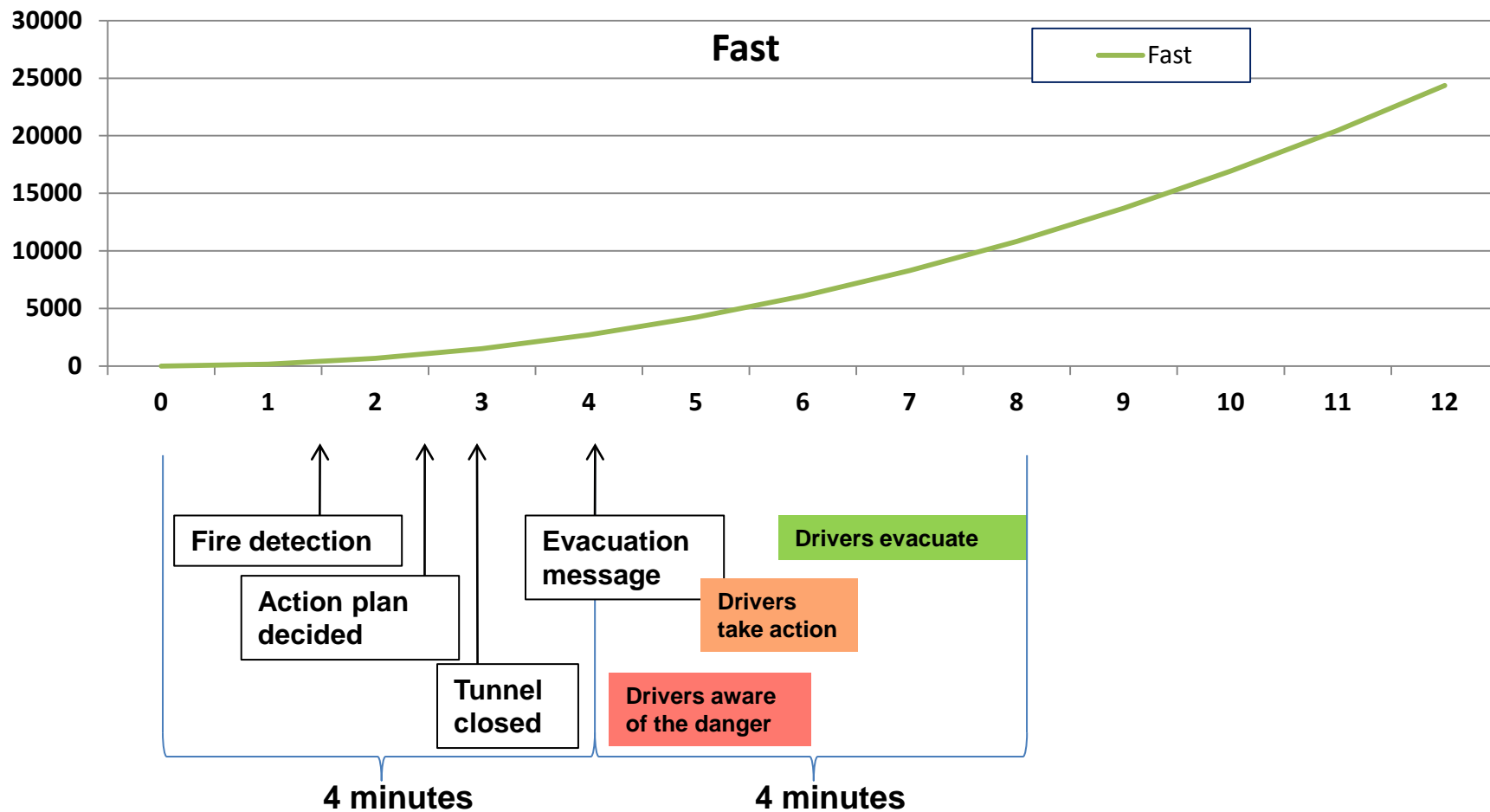
Noticeable

Weeks



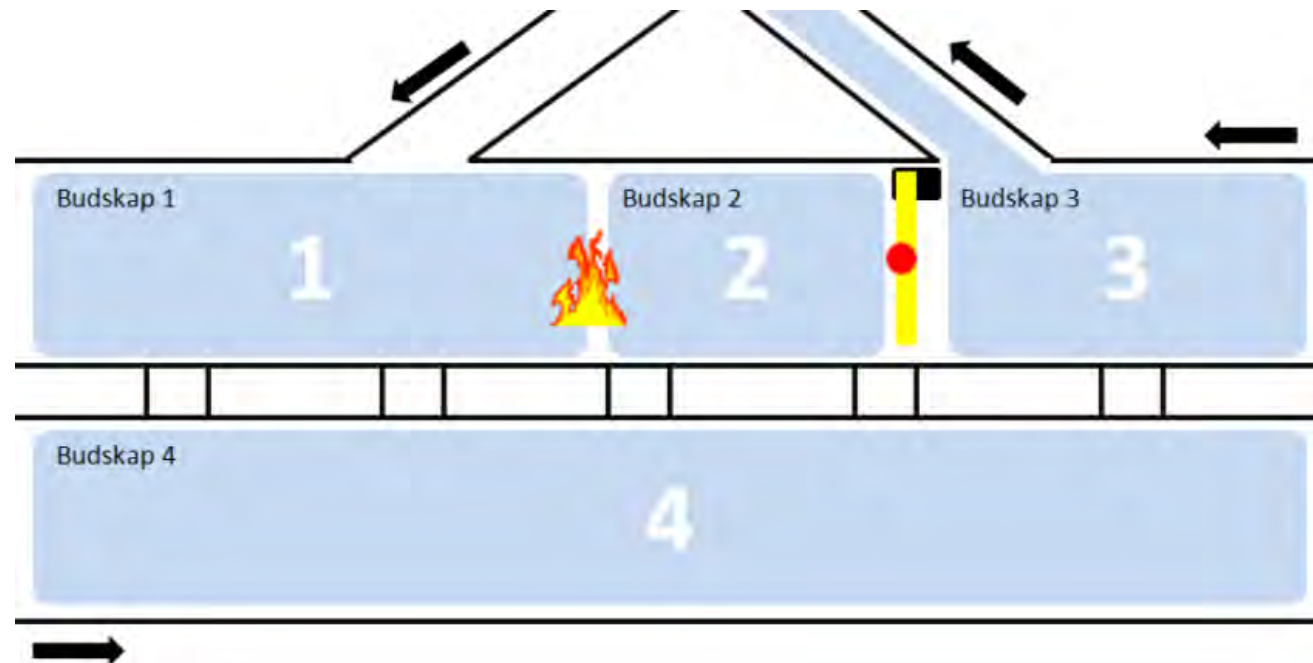


Fire safety design requirements, the Northern Link Tunnel



Alerting messages in different tunnel areas

1. Downstream of the fire
2. Between the fire and the traffic barrier
3. Upstream of the fire but with possibility to drive out
4. The other tunnel tube (safe place)





My conclusions for the Safety Officers tasks

- follow the project/tunnel continuously
- try to find the helicopter perspectives
- for the detailed questions; find the national experts and use their knowledge (thus you may need some extra money!)
- network in international organisations: ITA-COSUF, PIARC, ..
- be aware of that other stakeholders have other main objectives and that the final outcome will depend on the creation of win-win situations
- do not take over the responsibilities of the Tunnel Manager.