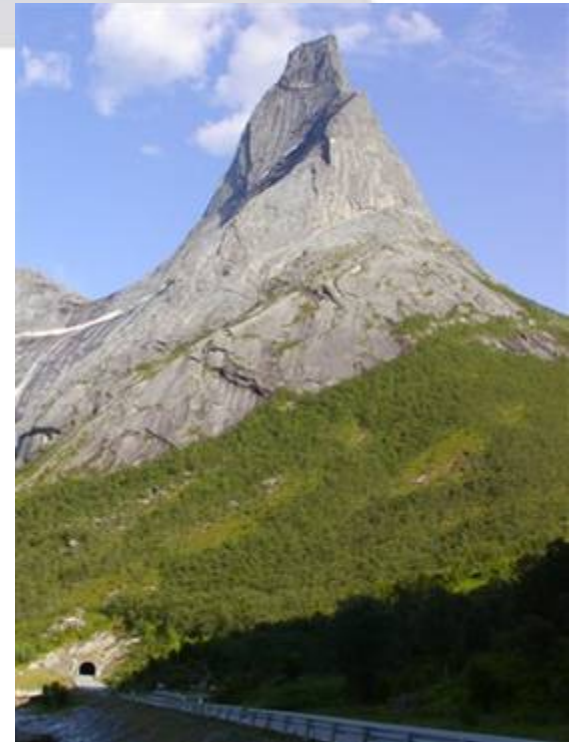


# Safe tunnels for environment and transport



Statens vegvesen

# Presentations

- The EU directive and how it is applied in the Nordic countries  
Asger Larsen, Denmark
- Fire safety and fireproof structures
  - Claus K. Larsen, Norway
- Water and frost protections, solutions and experiences
  - Heidi Berg , Norway
- Maintenance, an ongoing challenge
  - Johnny Rudolf, Sweden



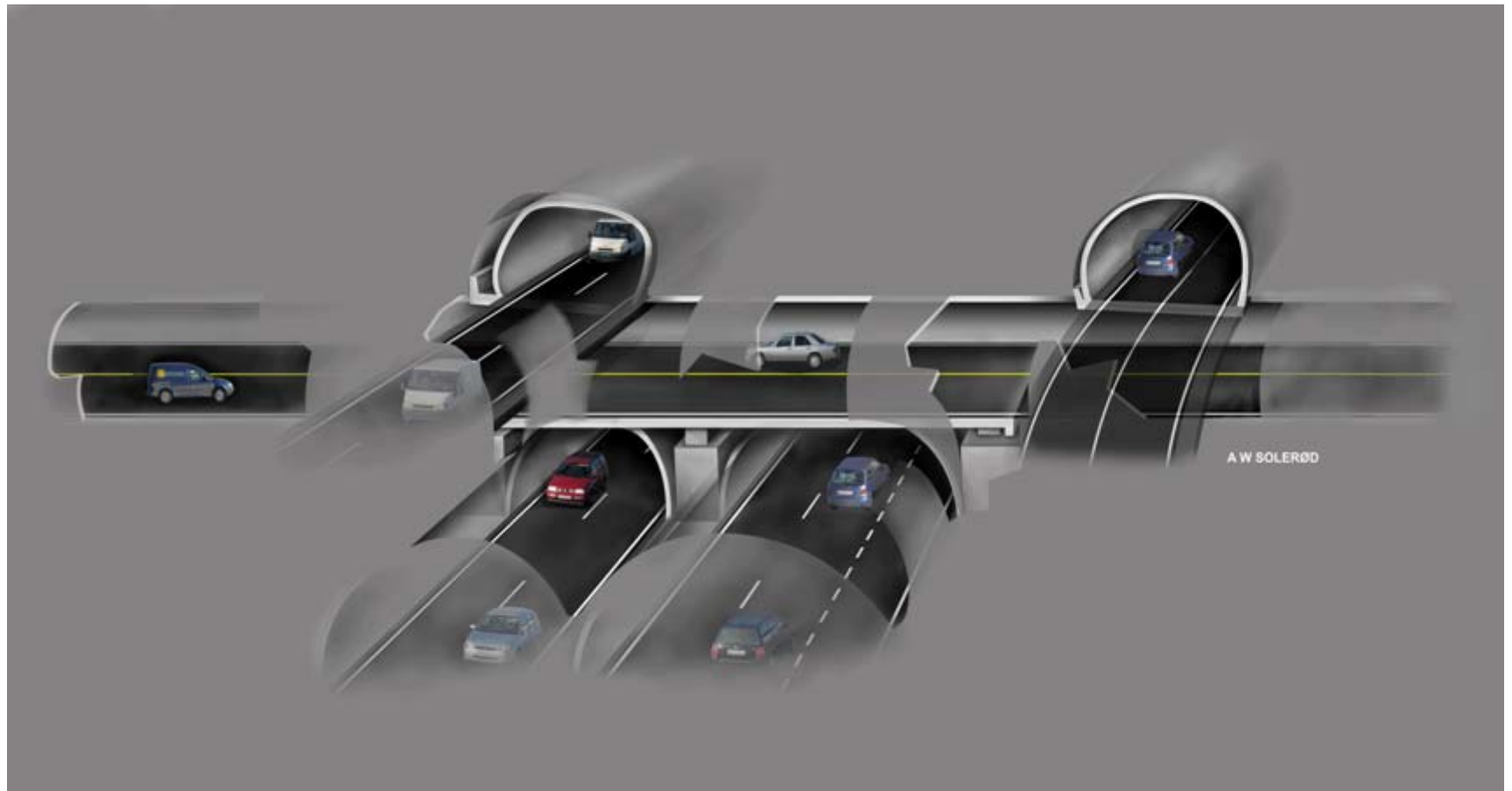
# Bjørsvika in Oslo-submerged tunnel



# Longest Tunnel: The Lærdal tunnel 24505 m



# Cross section in rock



# Hanekleiv Tunnelen, des. 2006



# Large fires in European tunnels



THE RUNEHAMAR

## TEST TUNNEL

Available as a future site for full scale fire testing and other tunnel safety tests





# New awareness

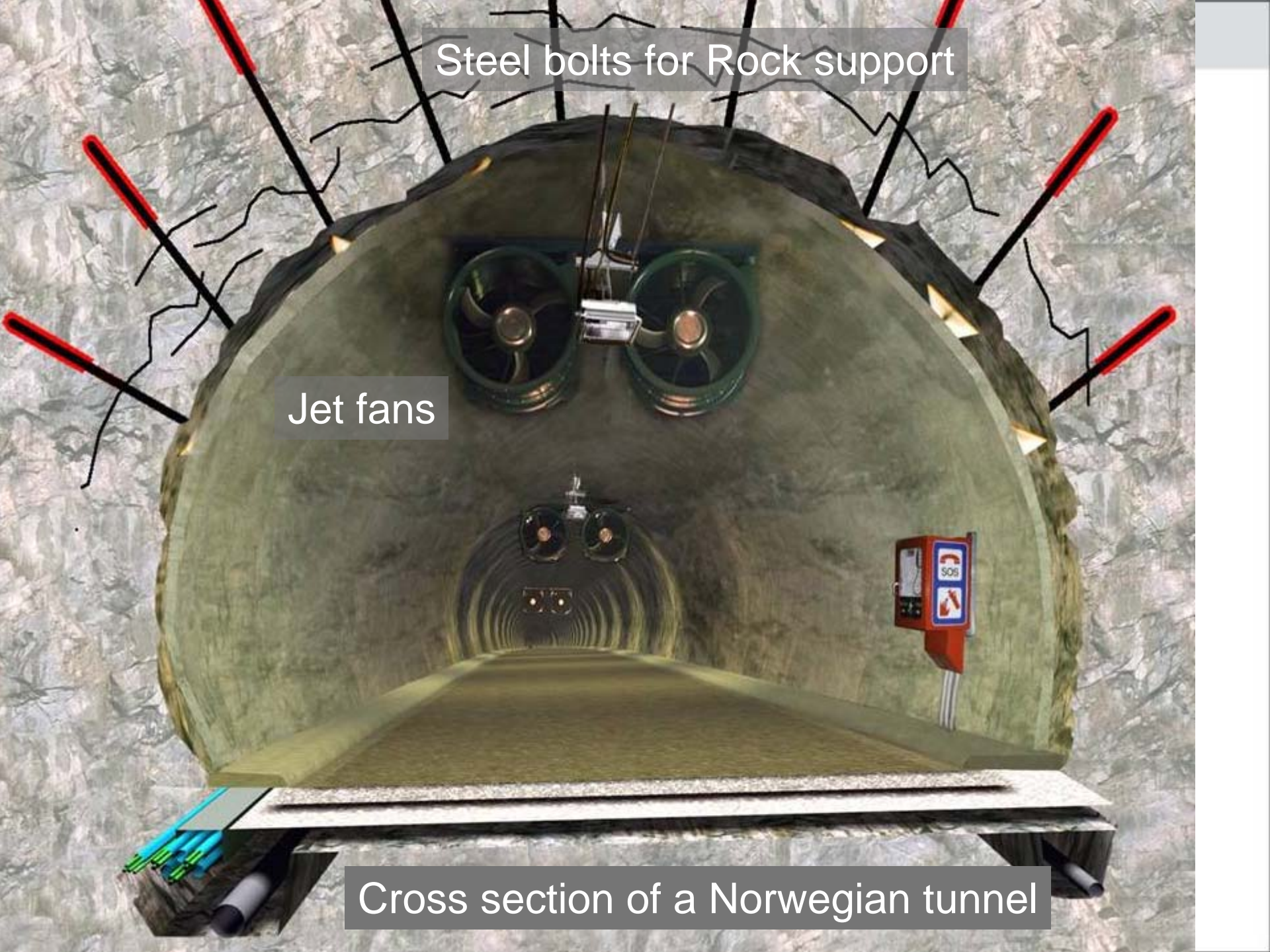
- Fire safety
- Geological construction, the rock
- Safety equipment and installations
- Safety and long term ownership
- Systematic maintenance



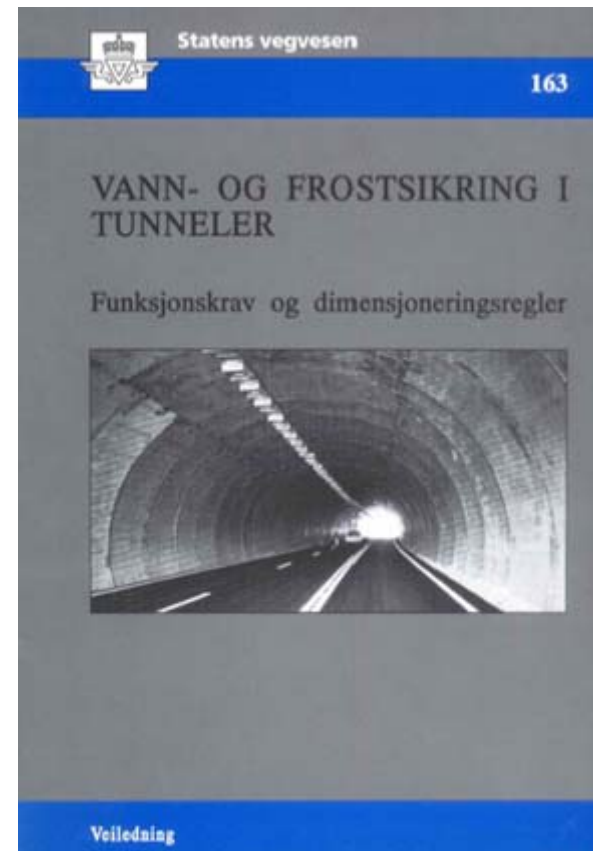
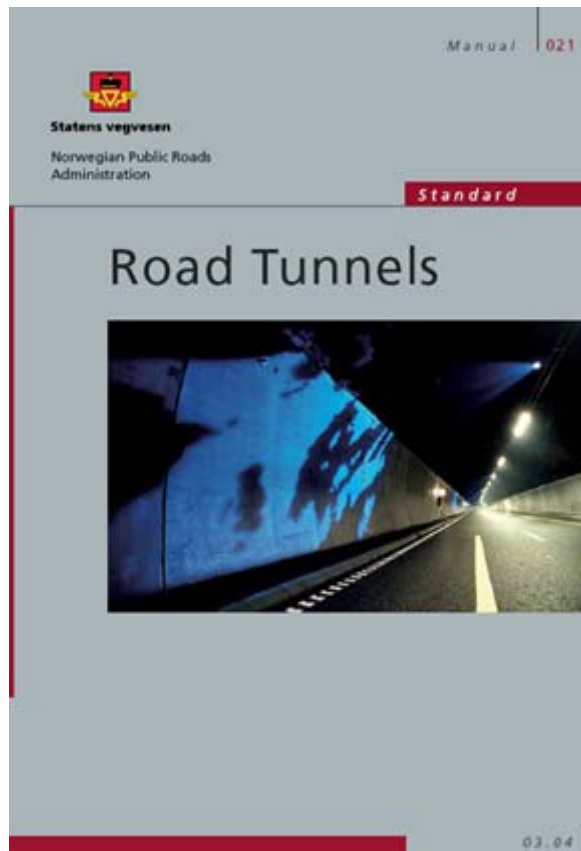
Steel bolts for Rock support

Jet fans

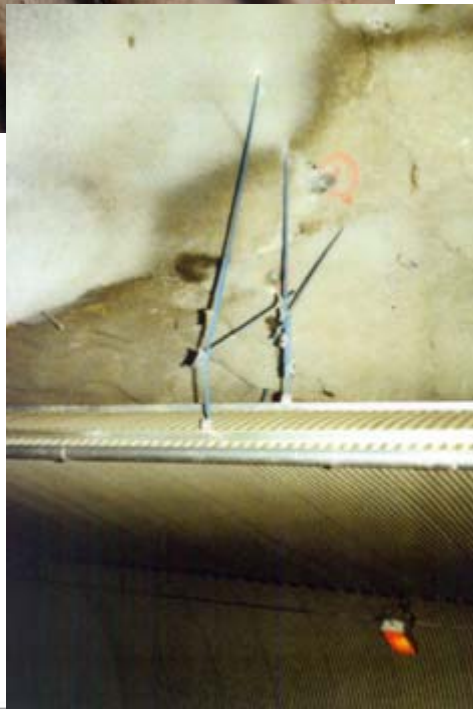
Cross section of a Norwegian tunnel



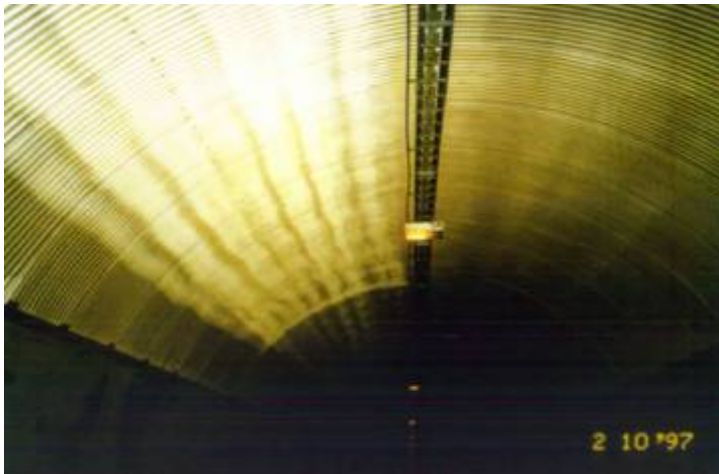
# Tunnel Guidelines



# Experiences must be shared



# Maintenance...Life cycle cost..



There is a growing concern and awareness for future quality, safety and cost related to maintenance, hence the relation between planning phase, construction and maintenance is put on the agenda.



■ Jernbane 
 ■ Veg 
 ■ T-bane 
 ■ Vannforsyning 
 ■ Vannkraft 
 ■ Avløp 
 ■ Lagringshaller 
 ■ Andre 
 ■ Anslått 1974

