



Statens vegvesen

Norwegian
Public Roads Administration



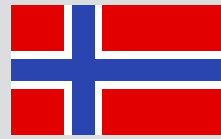
European forum of road tunnel safety officers
Lyon 4th-5th november 2009

Per Ivar Østensen

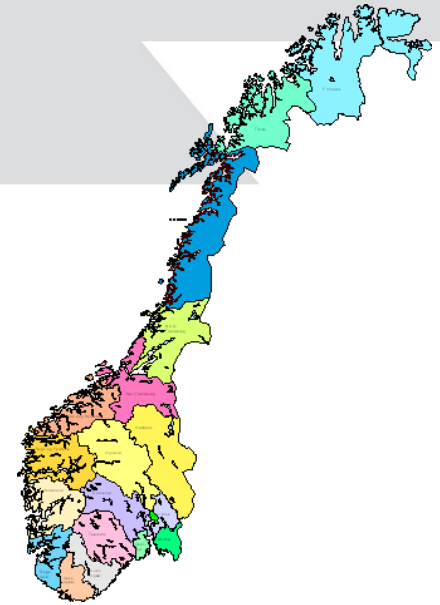
Corinne Chiodini

Safety officers Norway

Norway

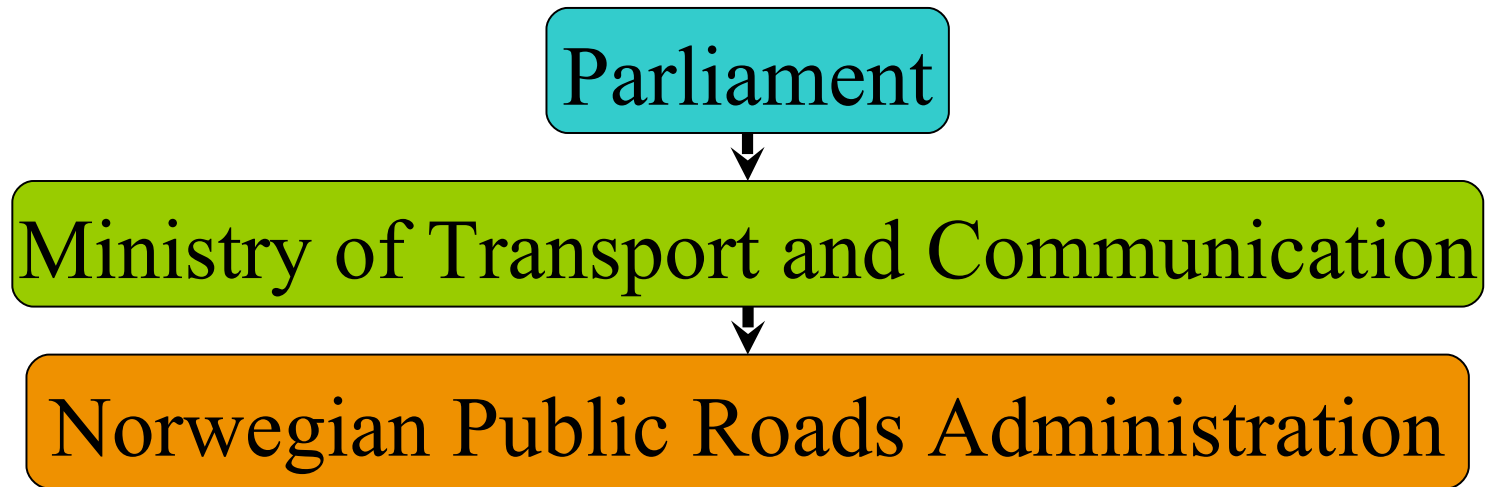


- 93000 km public roads
- 961 tunnels (858 km tunnels)

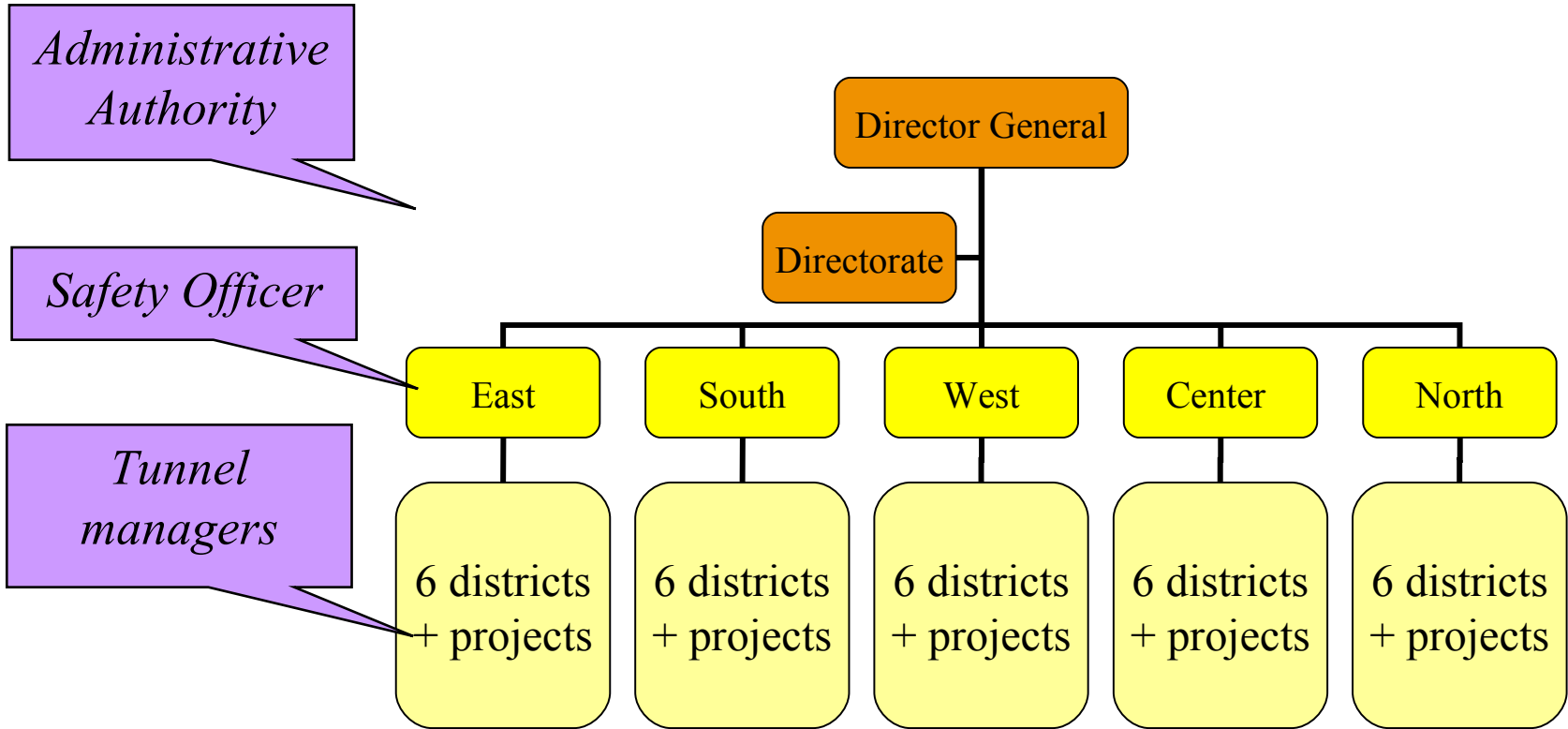


Organisation – NPRA

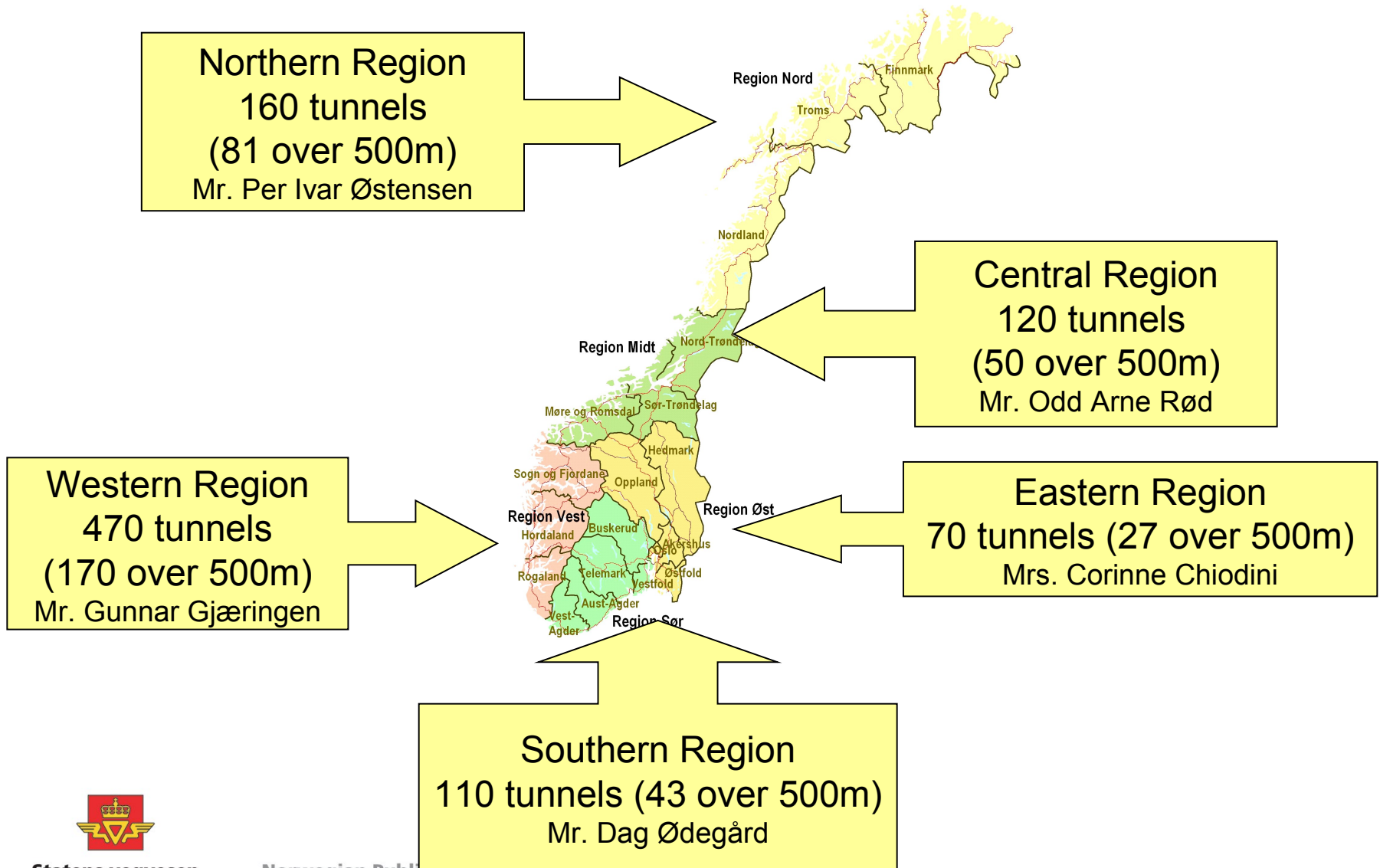
General Structure



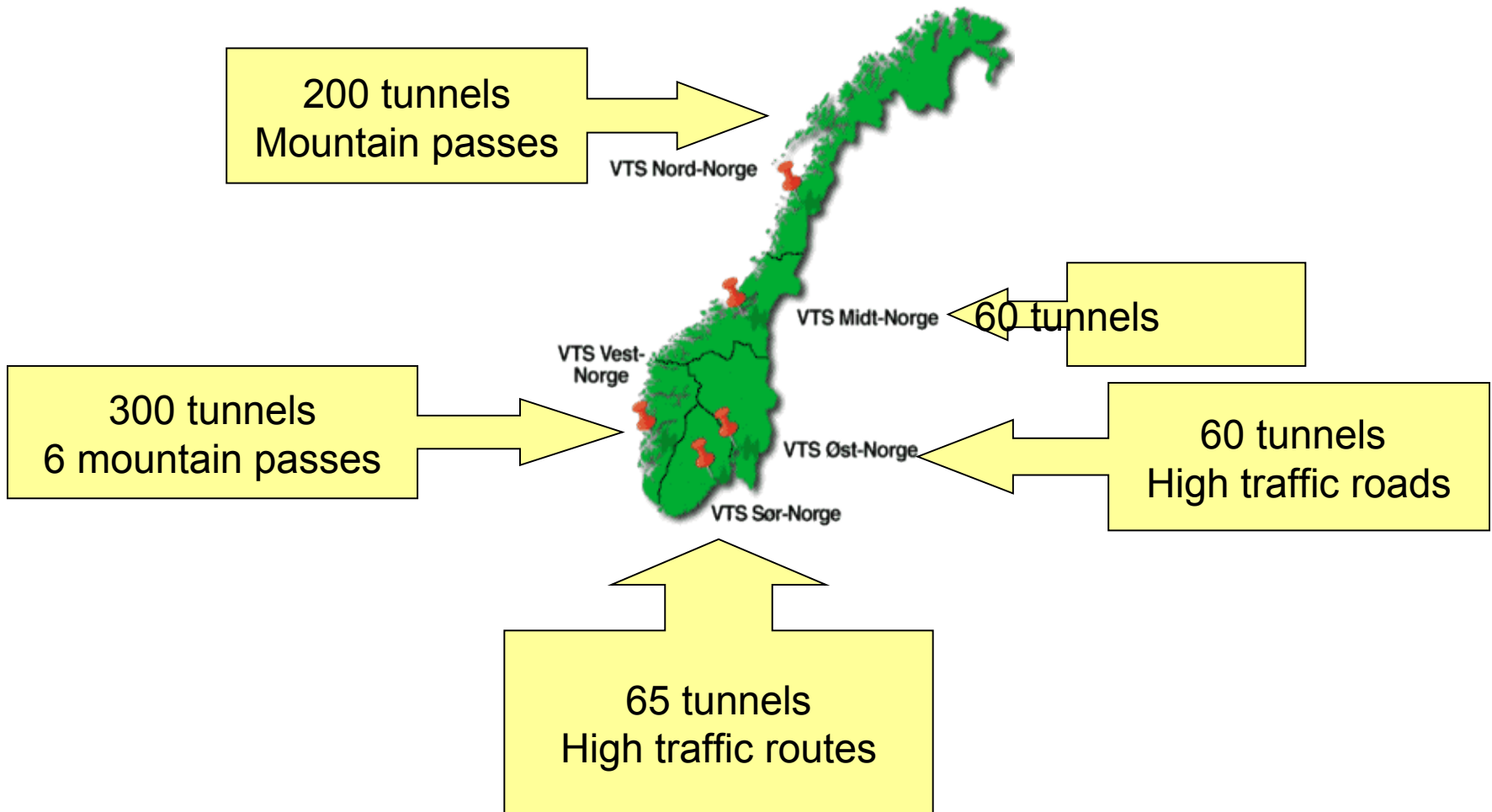
NPRA



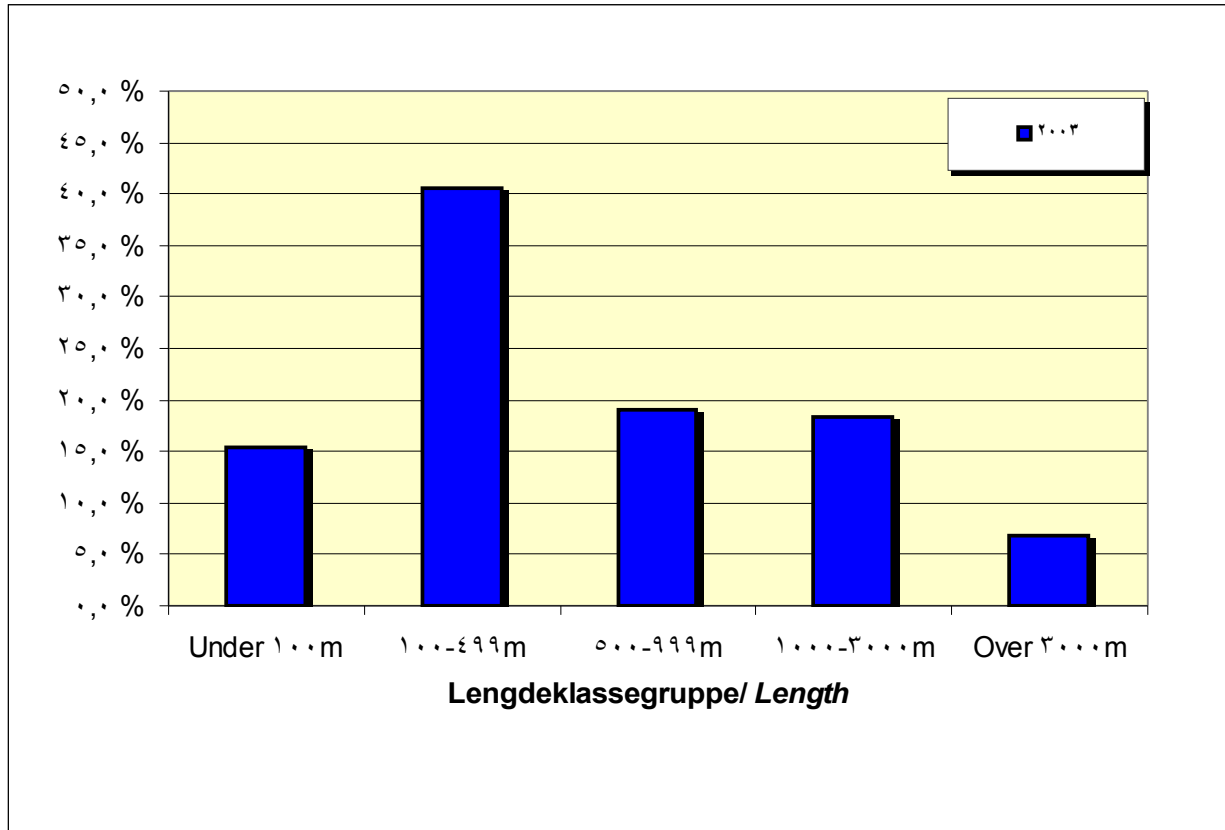
5 Safety officers i Norway



5 Traffic Control Centers



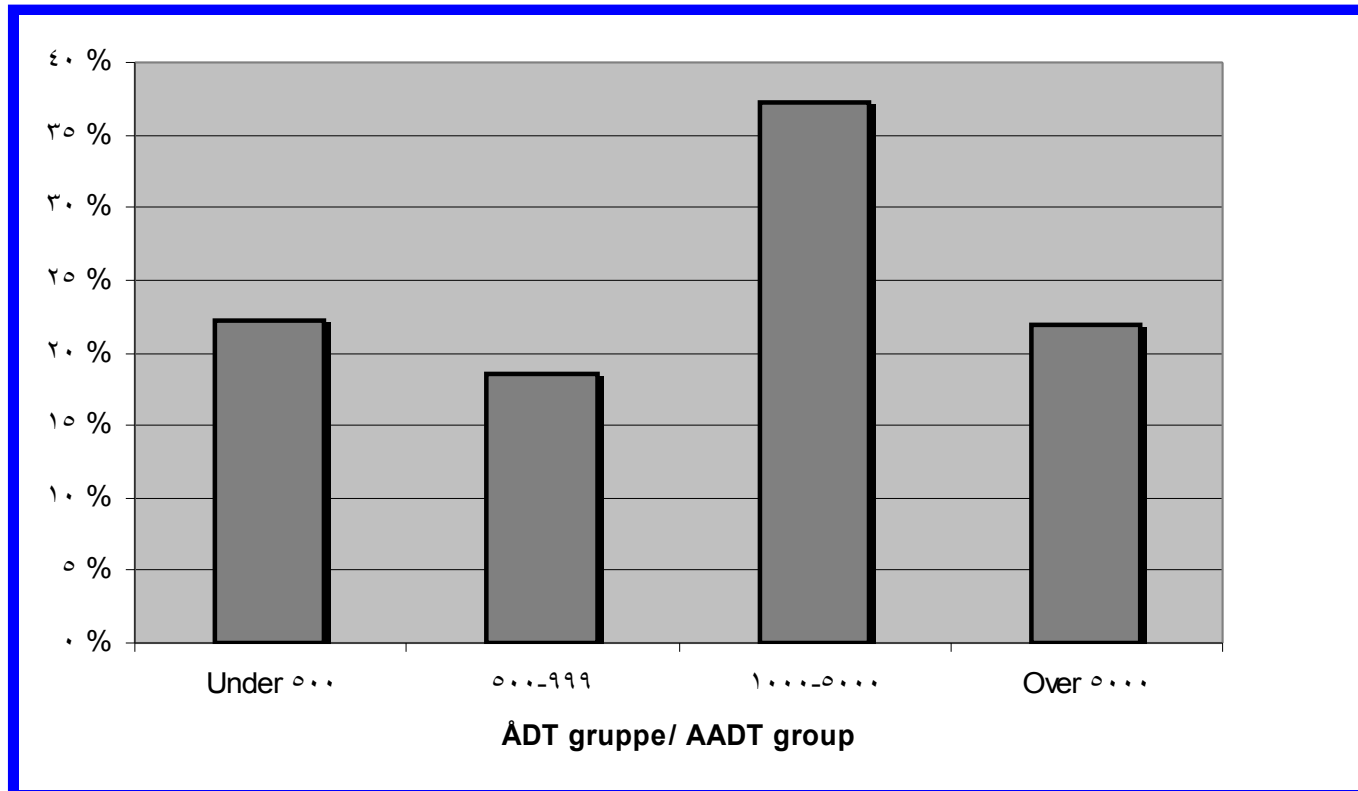
Norwegian tunnels are quite long



- The longest road tunnel, The Lærdalstunnel 24,5 km



Norwegian tunnels have low traffic



- The highest AADT, The Festningstunnel, in Oslo, 85.000



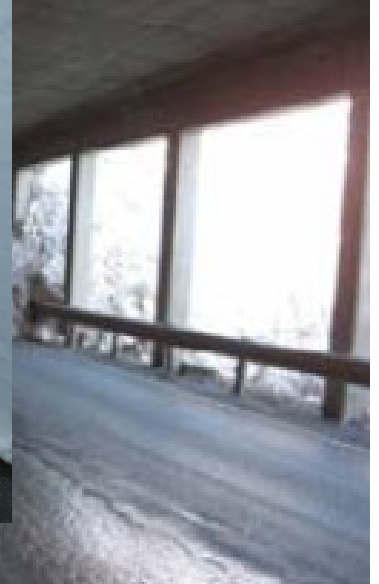
Need for road tunnels (low traffic)

- **High mountains**
- **Tough weather**
- **Deep fjords**
- **Scattered populations**
- **Only 4,5 million people**



Challenge in Norway

- Tough weather
- Winther



Challenge in West of Norway

- Harsh climate
- Landslides and avalanches



Challenge in North of Norway

- Reindeer !!!!!



Norwegian subsea tunnels



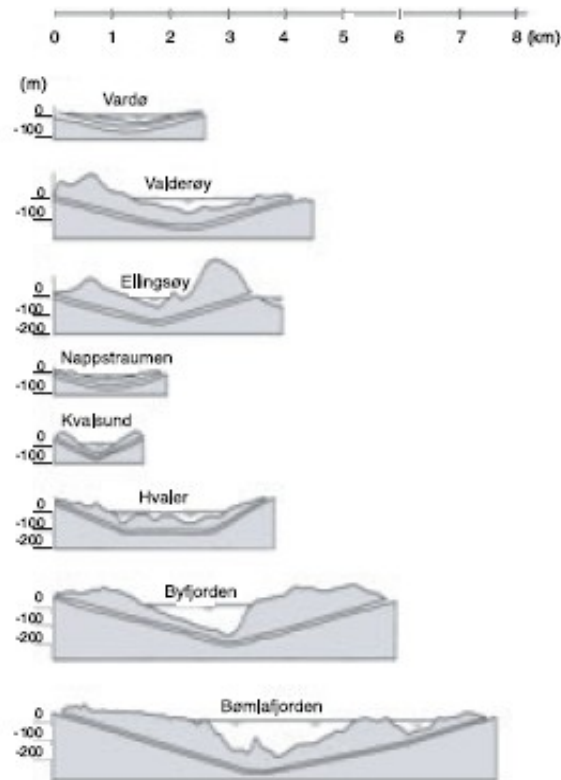
Subsea tunnel facts

- **24 subsea tunnels**
- **Traffic density between 100 – 7000 AADT**
- **Length between 1650 m - 7250 m**
- **Depth under sea level between -56 m – -287 m**
- **Gradients between 7% - 10%**



Sub-sea tunnels

- Challenge for subsea-tunnels: Gradient

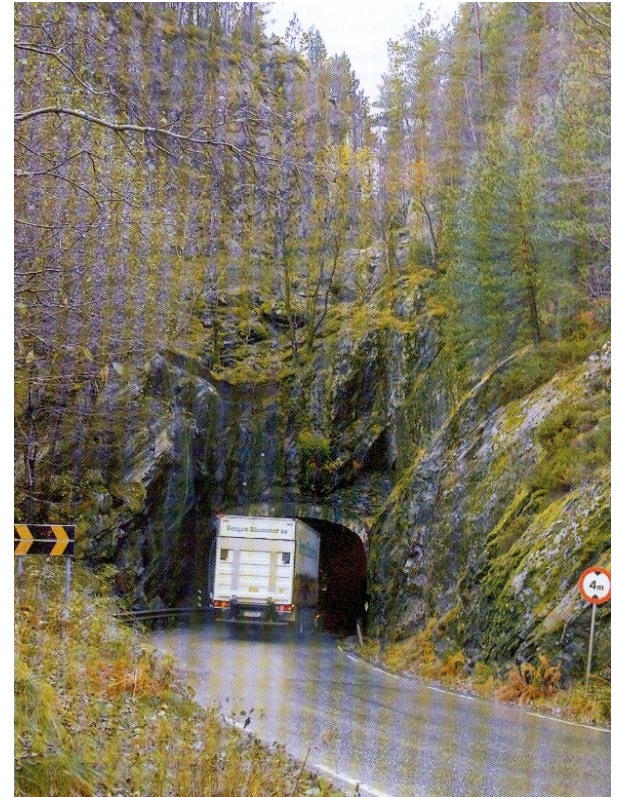


- Length and depth of some subsea-tunnels



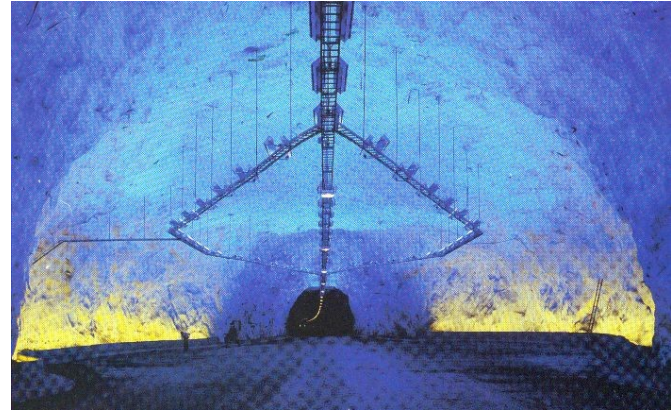
Challenge in Norway

- Many old tunnels
- Small cross section
- Poor lighting
- Little and poor safety equipment



New project / tunnels

- Good lightning
- Safety equipment ok
- Operation and maintenance of so many tunnels



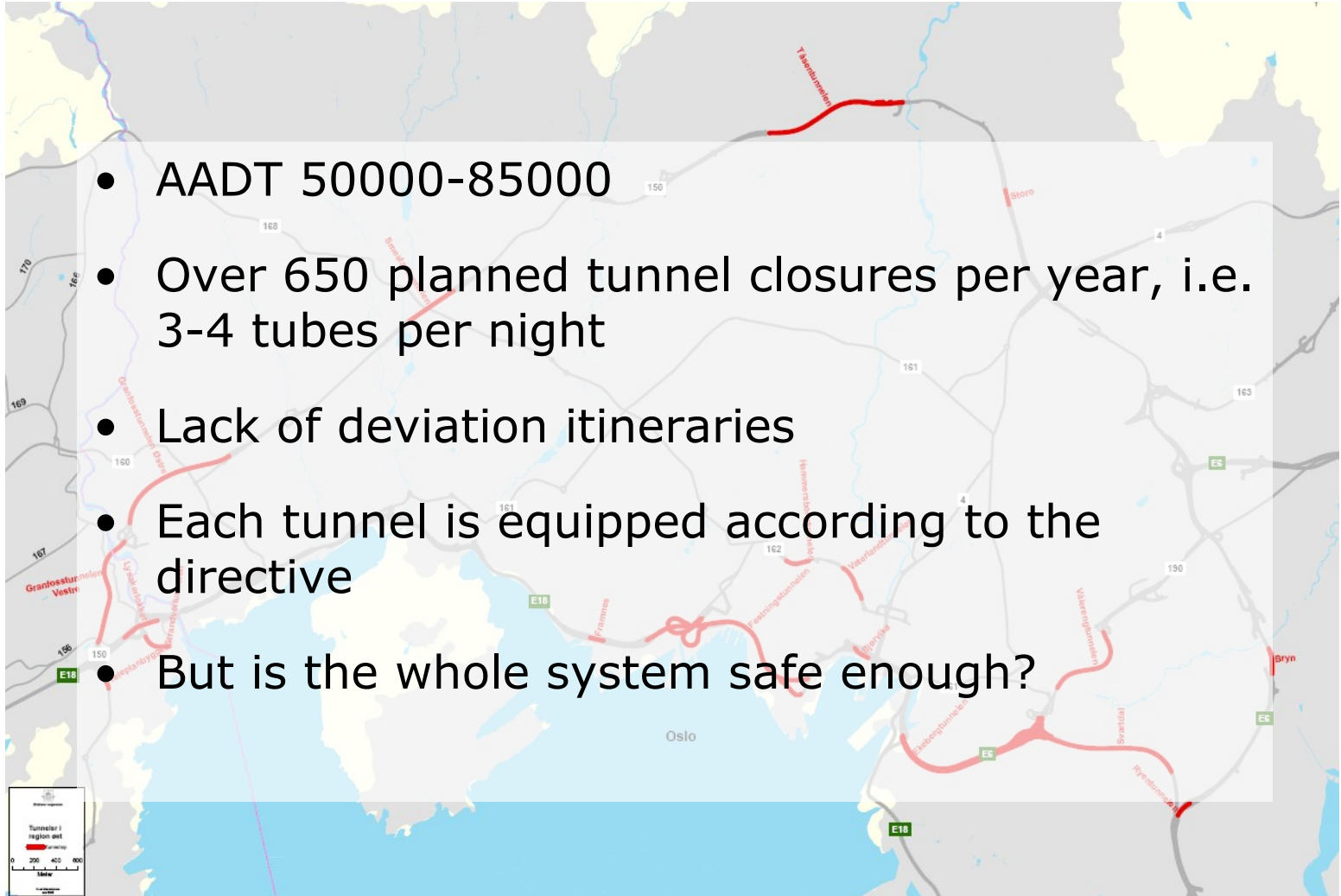
Need for road tunnels (high traffic)

- **Environment**
- **Air pollution**
- **Noise**
- **Motorways downtown**



Oslo has a complicated traffic system

- AADT 50000-85000
- Over 650 planned tunnel closures per year, i.e. 3-4 tubes per night
- Lack of deviation itineraries
- Each tunnel is equipped according to the directive
- But is the whole system safe enough?

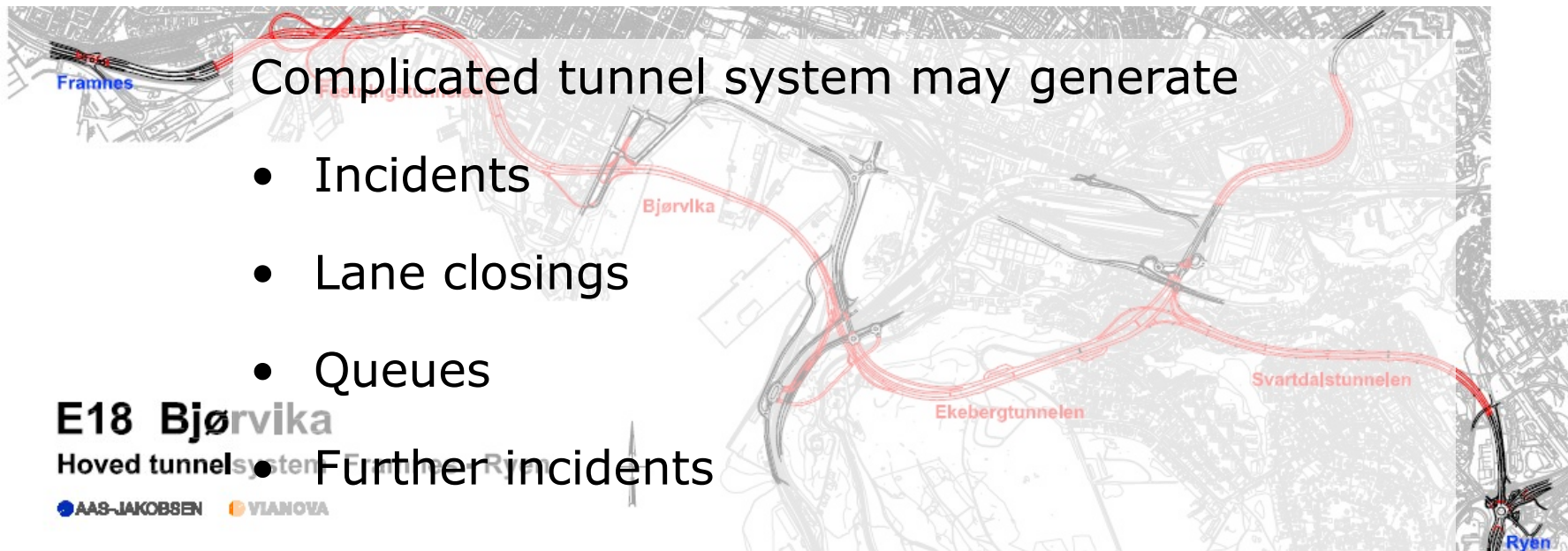


"Safe enough"?

- EU-directive is not precise enough where we need it
- Our tool is **risk analysis**
- But how can we evaluate the quality of a risk analysis?
- How can we discuss risk analysis?

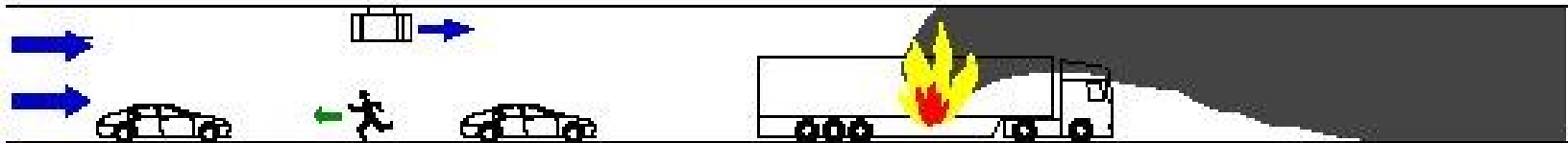


Subsea tunnel system with intersections, high traffic and queues



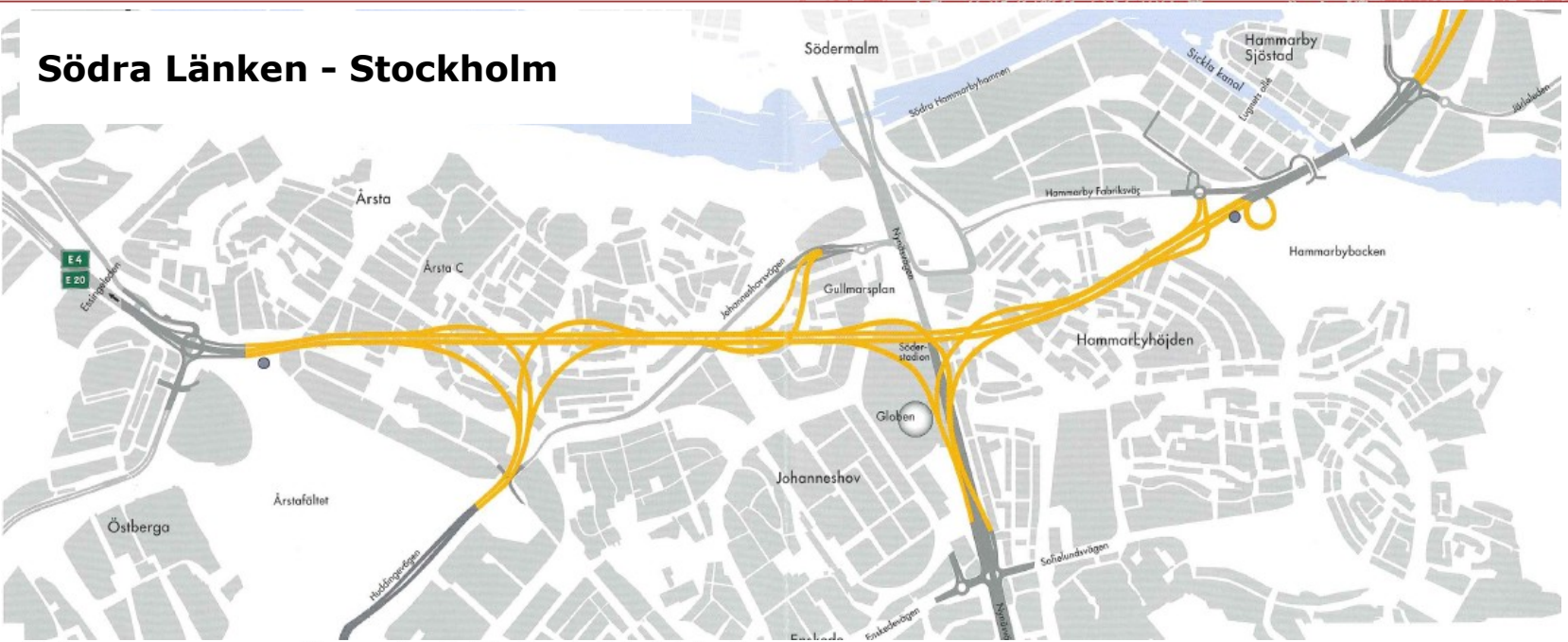
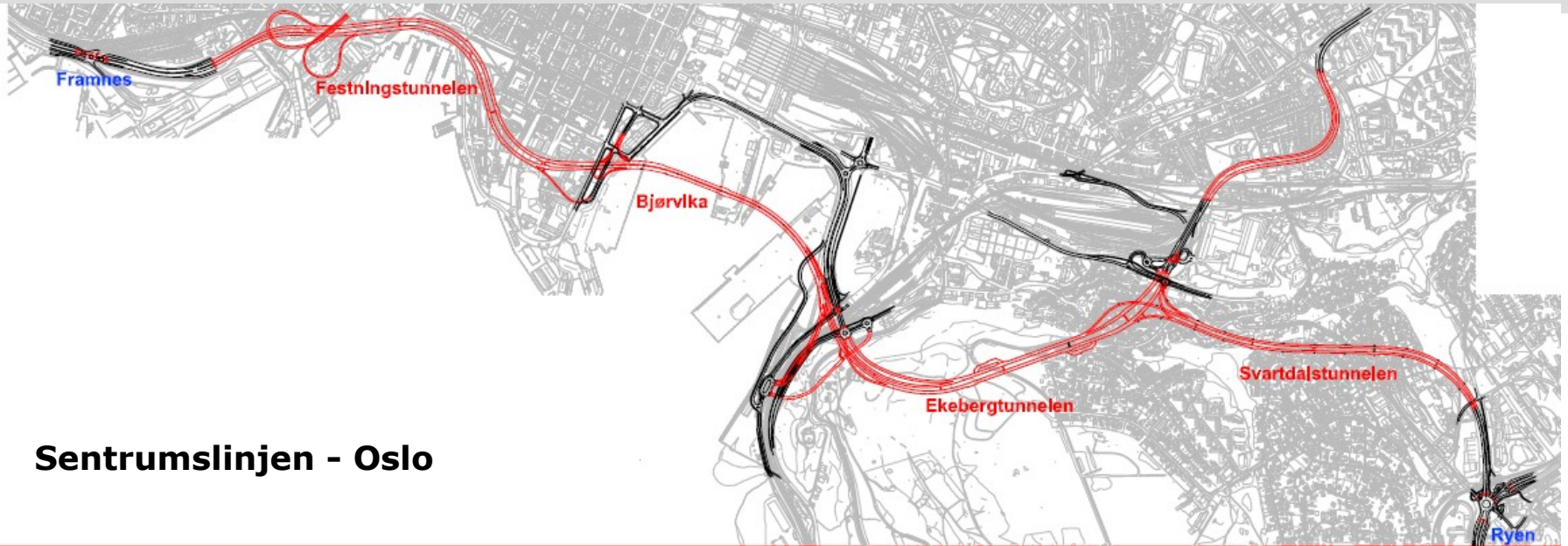
Longitudinal ventilation and traffic

- Only longitudinal ventilation in norwegian tunnels

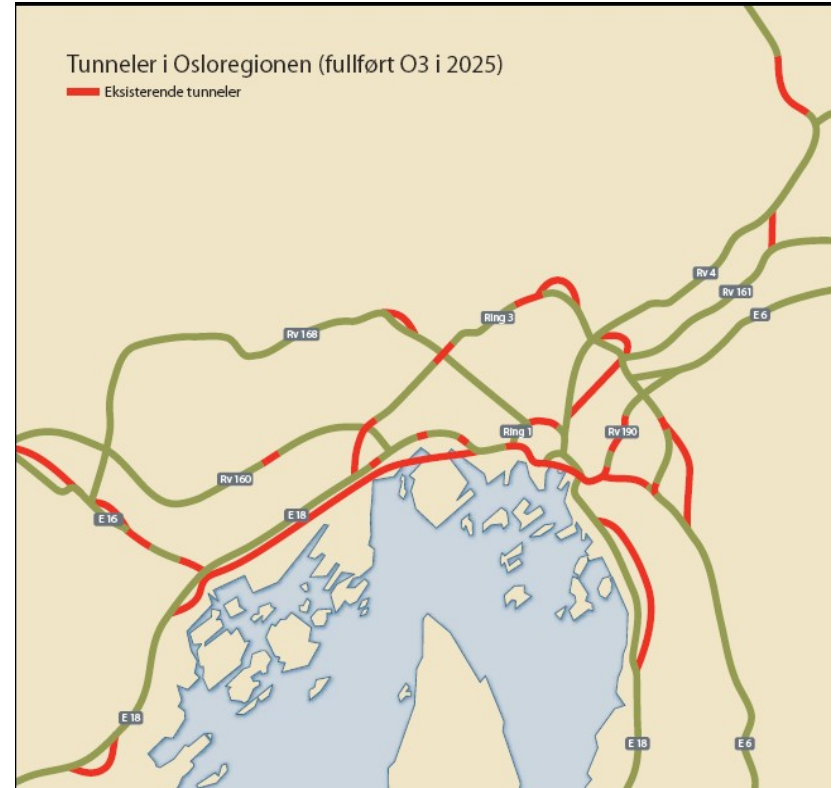
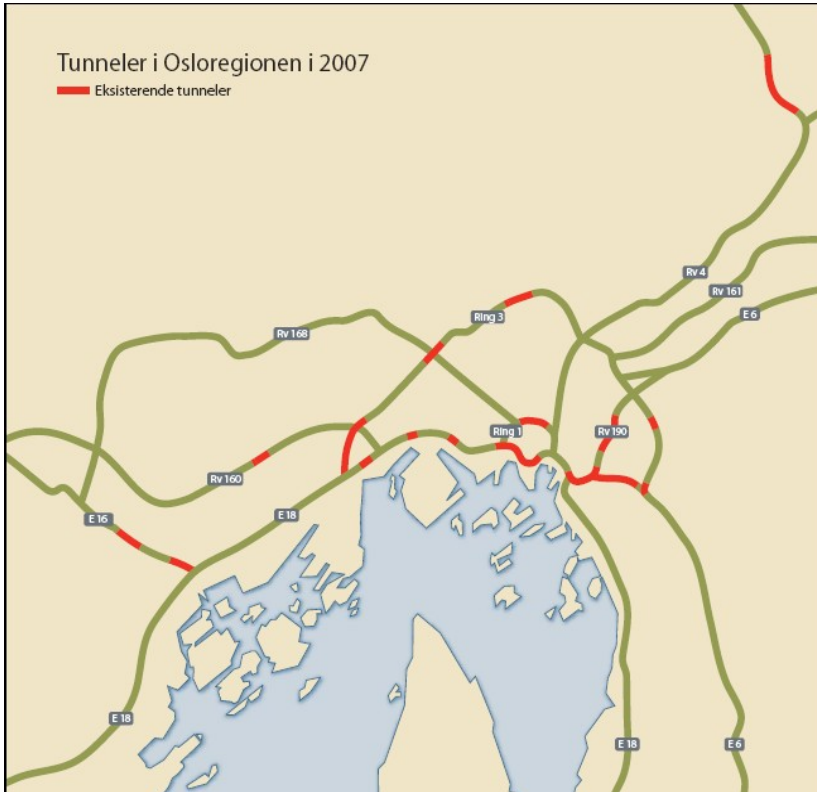


- The principle of self rescue implies no traffic congestion
- But avoiding congestion is a political issue





Tunnels are politically attractive

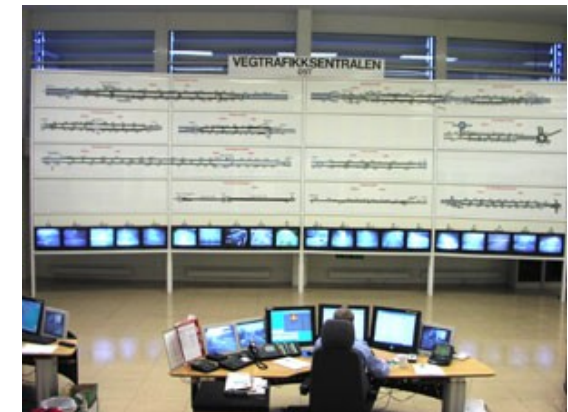


Dream or nightmare?



Main challenges in the East

- **Increasing number of tunnels and complexity**
- **Upgrading of mechanical and electrical equipment is necessary**
- **Upgrading of traffic control centers**



Our National mountain, Stetind

**Thank
you for
your
attention**

