

# Magic Numbers in Tunnel Fire Safety

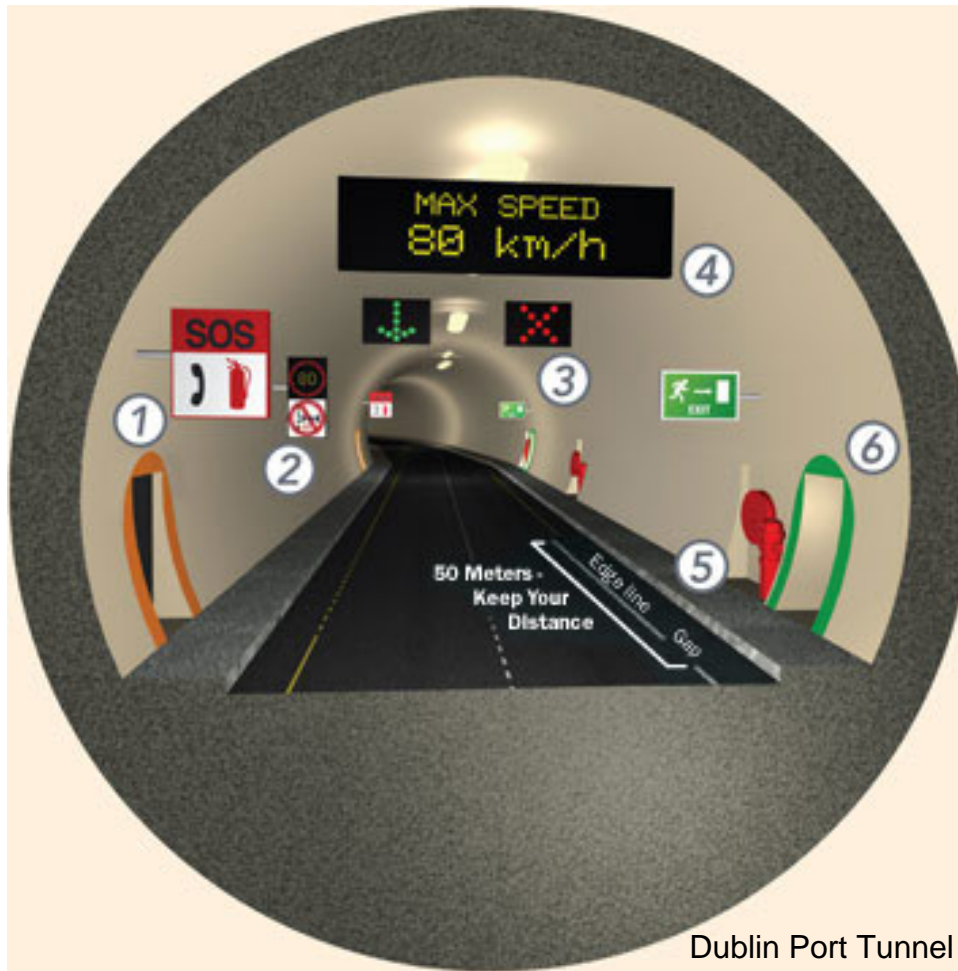
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# Safety concept of a road tunnel



1. Emergency Station
2. Speed Sign
3. Lane Control Signals
4. Electronic Variable Message Sign
5. Fire Fighting
6. Pedestrian Exit

Dublin Port Tunnel

# Tunnel Zoology



# Magic Number

A “magic number” is a technical design value obtained from a round table discussion of experts without any direct physical validation or traceable origin.



# Examples

## Design fires

5, 15, 30, 100, 200 MW

## Escape routes

150 m, 250 m, 500 m, 1000 m

## Temperatures

ISO, HC, RWS



# We need

to go from prescriptive guidelines with magic numbers to performance based guidelines with holistic design criterias relating to relative risk and consequences.



# Why performance based guidelines?

- More cost-effective solutions in complicated and new type of underground structures.
- There are methodologies available on how to work with performance based type of design in buildings
- The enormous research effort that has been conducted worldwide the past few years requires it.
- New innovative solutions will more easily find their ways into tunnel safety systems.
- We can optimise technical solutions and save money



# Problems ?

- We may have difficulties in determine the design fires.
- Engineering solutions also contain magic numbers
- The solutions may differ from project to project



# Why performance based guidelines?

- Technical trade-off can be excersized
- Example: Put in water spray/foam system and skip the rest !



# Conclusions

- A performance based guidelines for large tunnel projects can save money.
- Rational design approaches correlating to risks, traffic situation, fire load, tunnel geometries and boundaries.
- Research efforts requires changes in the guidelines.
- Entirely performance-based approaches to all aspects of the tunnel fire safety probably not possible.
- We still need magic numbers but not too many.