

# Ensuring fire safety in buses

Michael Försth,

Asbjørn Hagerupsen, Jan Petzäll



**Statens vegvesen**



SP Technical Research Institute of Sweden

## Problem: Regulation No. 118 – burning rate test

(See documents GRSG 94-33, 94-17, 93-15, 92-18, 91-19, 90-32, 90-16, 89-33, 89-23, and 88-21)

Test of horizontal flame spread (ISO 3795, FMVSS 302)



The test only considers horizontal flame propagation, and contains additional technical shortcomings such as interrupted combustion when test object burns too fast and falls apart.

# Are matches fire safe?



## Solution: Proposed fire tests for Reg. No. 118

Use of four established ISO/CEN tests, applied world-wide:

1. Flame spread for surface linings
2. Flame spread for floorings
3. Test for production of smoke and toxic gases
4. Measurement of heat release from a seat

Evaluation of:

- Ignition and flame spread behaviour
- Smoke production
- Toxic/irritant gas generation
- Heat release from seats in real scale

These are established test methods in transportation

→ Complying materials exist on the market



# 1. Proposed alternative test for Flame Spread

Flame spread test for surface linings  
(IMO Res. A.653(16), ISO 5658-2 (2006))



Criterion: Critical Flux at Extinguishment  $\geq 20 \text{ kW/m}^2$ . Same as for interior surfaces in trains and passenger ships.

## 2. Proposed alternative test for Flame Spread

European harmonised flooring test  
(EN ISO 9239-1 (2002))



Criterion: Critical Heat Flux at extinguishment  $\geq 6 \text{ kW/m}^2$ . Same as for floors and external roofs on trains.

### 3. Proposed test for Smoke and Toxic Gas production

Smoke test and analysis of toxic gases (IMO FTP Code Annex 1 Part 2, ISO 5659-2(2006))



Criteria: Requirements on smoke density and concentration of toxic species. Same as for interior surfaces on passenger ships.

## 4. Proposed test for Seats

Measurement of heat release  
(prCEN/TS 45545-2 Annex B)



Criterion: Maximum Average Rate of Heat Emission < 50 kW. Same as for seats on trains.



# Conclusions

- Buses and coaches lack requirements for an acceptable level of fire safety.
- A guaranteed acceptable fire safety level, meaning similar to the level in ships and trains, can easily be achieved by ensuring that materials:
  - resist fire for a longer period of time,
  - produce less smoke and toxic gases.
- This can be accomplished using established international fire tests, also used in other public transportation such as ship and train interiors. Therefore complying materials already exist on the market
- A proposed solution is found in draft amendment to Reg. No. 118 in informal document GRSG 95-19.
- This will guarantee time for evacuation, easier evacuation, more time to extinguish the fire, decreased risk in tunnels.

# Answers to ten questions raised during 94th GRSG 21-25 April 2008

Q1:10: Do fire properties of interior materials change with age?

A: Yes. This is however traditionally not considered in fire classifications.



# Answers to questions raised during 94th GRSG 21-25 April 2008

Q2:10: Do fire properties of interior materials change when one material is glued onto another.

A: Yes. According to for example the CPD (Construction Products Directive) it is mandatory to test a material, or a composition of materials, in its end use configuration in order to get a correct assessment of the behaviour in fire. Alternatively the worst case can be tested, if such a case is well defined.



# Answers to questions raised during 94th GRSG 21-25 April 2008

Q3:10: What fire properties do glues have that is typically used in interiors?

A: Glue is not considered as a major issue from a fire safety point of view. If glue is used in compound materials it should be a part of the test object, see also question Q2. Therefore the effect of glue will be included in the test result.



# Answers to questions raised during 94th GRSG 21-25 April 2008

Q4:10: Do flame retardants produce toxic gases?

A: Yes in the sense that the combustion becomes more incomplete. But toxic gases are also produced in underventilated fire without flame retardants. Flame retardants are not considered as a toxic problem in fire incidents.



# Answers to questions raised during 94th GRSG 21-25 April 2008

Q5:10: How dangerous is smoke from fires?

A: Very dangerous. In most cases it is the fire smoke that causes death, not the flames.



# Answers to questions raised during 94th GRSG 21-25 April 2008

Q6:10: Can the time available for escape be increased?

A: Yes. This is very important. The proposal guarantees that the heat release rate and production of toxic gases is kept at acceptable levels, meaning similar to the case for trains and ships. Using only ISO 3795 it is not possible to recognize and avoid materials that accelerate the fire and produce toxic gases at an unacceptable rate. Almost any material is allowed according to the ISO 3795 test!



# Answers to questions raised during 94th GRSG 21-25 April 2008

Q7:10: How long transition times are needed before the proposed new rules in Regulation No. 118 become mandatory?

A: This needs to be discussed with industry, authorities and other involved parties.





# Answers to questions raised during 94th GRSG 21-25 April 2008

Q8:10: What are the costs for developing fire safe materials that fulfil the proposed new rules in Regulation No. 118?

A: Exact cost is at the moment unknown. It depends on the willingness to adapt already existing materials for ships and trains.



# Answers to questions raised during 94th GRSG 21-25 April 2008

Q9:10: Can interior materials for trains and ships be approved for buses according to the proposed new rules in Regulation No. 118.

A: Yes. Since the proposed new rules and criteria are based on the requirements for ships and trains. There are many approved materials available.



# Answers to questions raised during 94th GRSG 21-25 April 2008

Q10:10: When will the standards referred to come into force.

A: The IMO FTP Code is already in force.

The standard prCEN/TS 45545-2 is soon to be finally voted.

