

Transmitted by the experts from Norway and Sweden

Proposal for bus fire safety improvement - summary of justification to proposed draft amendments to Regulation No. 118

## **1 BACKGROUND**

The number of bus fire incidents is large and there is a potential for catastrophic consequences when fires occur in connection to crash accidents. Recently in Poland a crash accident followed by a severe fire killed 13 young people and injured 40. The materials, construction and design of buses allowed today do not lead to an acceptable fire safety and there is a need for a review on this issue.

With the above background the Norwegian and the Swedish Road Administrations have initiated a research project together with SP Swedish National Testing and Research Institute, as reported before in the GRSG. The project started in spring 2005 and is finished in 2008.

The main targets of the projects can be summarised as

- Decrease the number and consequences of bus fires
- Prevent start of fires and delay start of fires
- Inhibit fire spread and smoke development in fire incidents
- Provide more time for escape in case of fire

These targets will be accomplished through generation of an increased knowledge about fire cause and fire development in buses. The results are now used as basis for proposal of concrete measures and changes in regulations to increase the fire safety of bus travelling.

### **1.1 Identification of problem with fire safety and risks.**

The project has confirmed that fire safety in buses is a significant problem. Statistics for Norway and Sweden show that as many as 1 % of the buses are involved in a fire incident each year, although fortunately only few fires develop<sup>1</sup>. If a fire gets hold in the passenger compartment there is a major risk of disaster due to very rapid fire spread and smoke development. Several fires with multiple casualties have happened in recent years and the potential for more disasters is significant.

As presented earlier in GRSG<sup>2</sup> a comprehensive test series on bus materials have shown the fire quality of a number of bus materials to be very low. Most of the tested interiors would not be allowed for use on trains, passenger ships or in escape ways, hotels or hospitals. Also the statistics have shown that fires in engine rooms are common and should be prevented to enter other parts of the bus by a fire barrier. Today there is no quantified requirement on these barriers and the introduction of a simple test requirement would be an easy way to decrease the risks substantially and provide more time to escape in case of a fire.

All results so far are summarised in article presented at Fire and Materials conference 2007<sup>3</sup>. The article also gives a review of U.S. research coming to similar conclusions. Recently in

September 2007 a paper<sup>4</sup> was given in London at the main international fire conference Interflam 2007 where the authors concluded "...FMVSS 302 [main fire test for buses/coaches and cars] is no longer relevant to automobile fire safety and recommend improved standards based on objective criteria for fire safety...". Among the authors were several major fire researchers and organisations like National Institute of Standards and Technology (NIST) and Motor Vehicle Fire Research Institute in the US.

It is evident that the fire safety in buses needs to be improved.

## **2 Solution**

Almost all public transport applications and buildings today have fire safety requirements that give a satisfactory level of safety. Examples are train transport, passenger ships and public buildings. General and advanced test methods to evaluate ignition, fire spread, smoke and toxic gases have been developed within ISO<sup>1</sup> and are used in several of the mentioned areas. As an example passenger ships (IMO<sup>2</sup>) uses ISO tests for evaluation of flame spread and smoke production, trains in Europe uses ISO tests for ignition, flame spread and smoke. Thus there exist established technical solutions on an international level to the fire safety problems in public transport.

The most rational way to gain an improved level of fire safety also in buses would be to draw on the experience from other similar areas, i.e. trains and passenger ships. Starting with the interiors, new fire test requirements for buses can be added to the existing requirements set out in ECE 118<sup>5</sup>. This approach will minimise the amount of research needed since the tests and criteria are established and known to give a good level of safety. More details are presented in the next section 2.1.

The next step will be to address the fire resistance of barriers and partitions, e.g. the engine compartment, and also extinguishment and detection of fire.

### **2.1 Proposals for amendment of Regulation No. 118**

This chapter outlines a possible technical solution that will result in an acceptable fire safety level in buses and bring them to a similar level as other public transport. The alternative tests are based on sound fire safety assessments and developed on an international level. The fire requirements are based on tests with following conditions:

- Fire tests shall be internationally available and be developed on international level
- The test shall be stable, well established and based on ISO standards
- The tests shall use standard technology known to result in acceptable fire safety in enclosures

#### **2.1.1 Interior materials and furnishings.**

In addition to present requirement in Regulation 118 the following alternative tests are a suitable way forward:

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<sup>1</sup> International Standardisation Organisation, [www.iso.org](http://www.iso.org).

<sup>2</sup> International Maritime Organisation, [www.imo.org](http://www.imo.org)

For interior surfaces: ISO 5658-2 (2006)<sup>6</sup> for evaluation of ignition and flame spread. Criteria from passenger ships (IMO) or EN train standard.

For all interiors: ISO 5659-2 (2006)<sup>7</sup> for evaluation of smoke production and toxic fumes. Criteria from passenger ships (IMO) and EN train standard.

For seats: Complete seats are tested according to prCEN TS 45545-2<sup>8</sup> where a seat is subjected to a flaming ignition source and the resulting heat release rate is measured. The ignition source is approximately equivalent to a burning newspaper.

## **2.2 Consequences on safety and costs**

Application of the proposed fire tests will result in a dramatically improved fire safety for buses, thus reducing the risk of future disasters substantially.

New requirements will also mean increased costs for manufacturers. In a transition period there will be development costs to find materials that satisfy the demands for fire safety. However experience from other sectors (trains, ships, public buildings) has shown that this is not a major problem and it is fully possible to solve.

## **2.3 Implementation in Regulation 118**

See Informal document at GRSG94 with proposal for draft amendments to Regulation No. 118.

## **3 References**

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<sup>1</sup> GRSG 90-32 Fire Safety in Buses.

<sup>2</sup> GRSG 89, 92, SE and N presentations on Fire Safety in Buses.

<sup>3</sup> Axelsson et.al, Fire Safety in Buses, Proceedings of Fire and Materials conference 2007, San Fransisco, Interscience Communications Ltd, London 2007.

<sup>4</sup> Digges et. al., "Improving Survivability in Motor Vehicle Fires", Proceedings of the Interflam 2007 conference, London, 2007.

<sup>5</sup> E/ECE/TRANS/505, Regulation No. 118, Rev.2/Add.117, "Uniform technical prescriptions concerning the burning behaviour of materials used in the interior construction of certain categories of motor vehicles", United Nations, 20 April 2005.

<sup>6</sup> ISO 5658, Reaction to fire tests -- Spread of flame -- Part 2: Lateral spread on building and transport products in vertical configuration, International Organization for Standardisation, 2006.

<sup>7</sup> ISO 5659-2:1994, Plastics -- Smoke generation -- Part 2: Determination of optical density by a single-chamber test, International Organization for Standardisation, 2006.

<sup>8</sup> prCEN TS 45545-2 Railway applications - Fire protection of railway vehicles - Part 2: Requirements for fire behaviour of materials and components, CEN, February 2008.

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