The long march towards reaching European Fire Safety Standard EN 45545 started in 1991. The initial reason given for preparing such a document was to ensure ‘Minimal Trade Barriers’ among European countries. After extensive studies, the interim Technical Specification TS 45545 was released in 2009.

Within this framework, the Technical Specifications for Interoperability (TSIs) have been conceived. Those mainly concerning rail vehicles are Safety in Railway Tunnels (SRT TSI), High-Speed Rolling Stock (HS RS TSI) and Conventional Rolling Stock (CR TSI). All are intended to allow for harmonious interoperability of rolling stock within the European Union.

A particular problem faced by the Committee developing TS 45545 was that each major European state had their own individual test methods – usually based on local building regulations – for local specifications. Naturally all these regulations would be obsolete following the adoption of EN 45545; however the lack of a generally accepted comparative measure between the national standards has slowed down the adaptation process.

**TRANSFEU PAVES THE WAY**

The main objective of the Transfeu* project, which began in April 2009 [see box], is to pave the way to a true European standardisation (especially through finalising EN 45545), by developing a fire-safe, performance-based design methodology to efficiently support the standardisation of European surface transport. Within this framework, the project particularly aims at contributing to the finalisation of CEN EN 45545 Part 2 by developing dynamic measurement of toxicity and developing Fire Safety Engineering (FSE) and simulation processes as a possible alternative to the existing Fire Safety Regulation and Standard (TSI and TS 45545). The four focus points are:

1) Creation of an accurate measurement tool for toxic gas fire effluents under dynamic conditions for ‘Public Transport Guided Systems’, which would allow continuous recording of toxic gas concentrations
2) Deeper understanding and more detailed measurement of the underlying dynamic phenomena triggering fires
3) Development of a fire safety engineering methodology that offers the necessary modelling tools for establishing realistic and acceptable economic levels of fire safety, without unnecessary constraints on vehicle or vessel design
4) Validation of the above conclusions, using controlled tests on construction elements that replicate vehicles in service. (Full/real size tests)

Transfeu is supported by the European Commission through the 7th Framework Programme (FP7, 2007-2013). The project began on April 1, 2009 and will run for 42 months. The total cost is €5,547,813, with the EU contributing €3,658,183.
The project is divided into three phases. The first will be carried out in 2010 and consists of measuring dynamic toxic effects, with output being used to support completion of EN 45545–2. This data will help update the specification and, as a result, the current toxic emission requirements based on measurement of toxic output at four and eight minutes will be rendered obsolete.

Phase two will focus on adopting a fire-safe design approach and a new generation of realistic and dynamic simulation methodology for toxic fume emissions during fires. Finally, new initiatives for safety in public surface transport, which is subject to continuous improvement, will be formulated.

These latter phases will be completed in the remainder of the project, which is scheduled to finish in 2012.

**TS 45545 – OPERATIONS**

This Technical Specification consists of seven parts. In the first, operations are categorised as:

- ‘Vehicles that are not designed or equipped to run on underground sections, tunnels and/or elevated structures and which may be stopped with minimum delay, after which immediate side evacuation to a place of ultimate safety is possible’ (Category1)
- ‘Vehicles that are designed or equipped to run on underground sections, tunnels and/or elevated structures, with side evacuation available and where there are stations or emergency stations that offer a place of ultimate safety to passengers, reachable within a short running time’ (Category2)
- ‘Vehicles that are designed or equipped to run on underground sections, tunnels and/or elevated structures, with side evacuation available and where there are stations or emergency stations that offer a place of ultimate safety to passengers, reachable within a long running time’ (Category3)
- ‘Vehicles that are not designed or equipped to run on underground sections, tunnels and/or elevated structures and which may be stopped with minimum delay, after which immediate side evacuation to a place of ultimate safety is possible’ (Category4)

Design categories and vehicle classifications are also specified in this part and TS 45545 defines prescriptive limits for each category. This means that with regards to Euro Norm standards, if a train travels through a single tunnel exceeding the prescribed length it must meet the higher category standards.

Ignition sources are also analysed in part one. An overview of train fire history throughout Europe reveals that although there have been few major incidents, there have been many that have caused smaller local disruptions. These fires are generally caused either by technical failures or arson attacks. The latter are usually ignited with paper waste such as discarded fast food packaging.

**PART 2 – MATERIALS AND COMPONENTS**

This describes the requirements for fire behaviour of different materials and components and their related test methods. TS 45545 provides
detailed prescriptive patterns by defining over 50 variations of component/material classification, together with a set of rules on how to manage minor components. Validations of materials/system fire performance (flame spread, smoke emission and heat release) are determined using various ISO (International Organization for Standardisation) tests (ISO 5658-2, ISO 5659, ISO 5660-1, ISO 5659-2).

PART 3 – FIRE BARRIERS

Fire resistance requirements for fire barriers are described here, according to vehicle and operating category (from Part 1). This acknowledges the difference in risks to passengers in the event of a fire in, for example, metro-type trains where stations (and off-board places of safety) are only a short running distance away from each other, and Intercity trains or sleepers where help is some time away, and there places of relative safety on board. This differs from BS 6853, which has the same fire barrier requirements for every rail vehicle.

For TS 45545 Operation Category 1 or 2 floors there are no Fire Resistance requirements. This follows a general reduction in requirements for fire barriers compared to BS 6853. However due to some method changes, this will not necessarily result in different design solutions. For example, BS 6853 allows testing of unloaded, small-scale test pieces (replicating typical point fire sources). TS 45545 calls for testing of large-scale specimens that are equipped ready for service.

PARTS 4 & 5 – ROLLING STOCK AND DESIGN

 Defines fire safety requirements for railway rolling stock design and address the issues related to mechanical and interior design. And in Part 5 focuses on electrical design. No major issues to existing U.K. standards are being identified for either of these documents.

PART 6 – CONTROL AND MANAGEMENT

 For this part, which addresses fire control and management systems requirements, we see that TS 45545 places much greater emphasis on the detection of fires than current national standards. There are also requirements for shutting down ventilation systems, which follow standard building practices, e.g. ventilation should be shutdown in a zone where the fire has been detected. This practice restricts the availability of oxygen needed to feed a fire.

PART 7 – FLAMMABLES

Here fire safety requirements for flammable liquid and flammable gas installations are elaborated for vehicles fuelled by flammable liquids, e.g. diesel, or used to cook with. It only considers fuels currently in use on the railways,
so any innovation requiring the acceptance of new fuels may involve modifications or different management systems before their use is permitted.

Since Transfeu is one of the most important initiatives (also in economic terms) currently underway to address the safety of passengers and crew in the event of a fire, its findings will be used to finalise the EN 45545-2 standard by closing the open points in the CR TSI, SRT TSI and HS RS TSI. Transfeu will define the EN standard for conducting measurements and classifying products. Then models will be developed to predict the fire behaviour and growth in fire scenarios for public transport guided systems. The unofficial date for implementing EN 45545 is 2012.

SPREADING IMPACT

Given that the fire safety objectives for the European standard are slightly more severe than for their national equivalents, the introduction of TS 45545 will make great changes to the management of fire safety design on board trains in Europe. Due to the number of new and different requirements, designs will be validated using a completely different approach. The latest European standard might be slightly stricter than its predecessor but as the details are specified in detail, compliance justifications may in fact require less effort.

There are claims that the prescriptive approach used might reduce innovation in train design. However current proposals can still be challenged before the EN is formally issued, to pave the way for improvements.

Transfeu partners will ensure the new prescriptive classification is sufficiently flexible to allow innovation by bringing together the interdisciplinary expertise of Europe’s leading rail manufacturers and operators, research organisations and standardisation bodies.

Adoption of the final document will definitely represent a giant step forward in concerted action among EU countries to make travel safer in Europe.

Dave Tooley, Bombardier Transportation Transfeu project

All photos: UNIFE

*for more information visit www.transfeu.eu