Example of application of FSE for railway

> EC TRANSFEU Project
> Final Conference
Hotel Marivaux, Brussels
25th September 2012

Arnaud MARCHAIS   RATP
Content

• General context
• Transfeu process
• Conclusion
General Context

• COMMISSION DECISION of 20 December 2007 concerning the technical specification of interoperability relating to ‘safety in railway tunnels’ in the trans-European conventional and high-speed rail system

• COMMISSION DECISION of 21 February 2008 concerning a technical specification for interoperability relating to the ‘rolling stock’ sub-system of the trans-European high-speed rail system

• prEN 45545-1, “Railway applications — Fire protection on railway vehicles”
General Context

COMMISSION DECISION of 20 December 2007

(11) Where innovative solutions are proposed the manufacturer or the contracting entity shall state the deviation from the relevant section of the TSI. The European Rail Agency will finalise the appropriate functional and interface specifications of the solution and develop the assessment methods.

(16) The objective of this TSI was to guide the technical progress in tunnel safety towards harmonised and cost-efficient measures; they should be as far as reasonably practicable the same all over Europe.
General Context

FINAL DRAFT FprEN 45545 Railway applications - Fire protection on railway vehicles

1 Scope
The measures and requirements specified in EN 45545 are intended to protect passengers and staff in railway vehicles in the event of a fire on board.

…The ultimate objective in the event of a fire on board is to allow passengers and staff to evacuate the railway vehicle and reach a place of safety. The present European Standard describes the measures to be taken in the design of the vehicles in the context of the infrastructure on which they operate.
TRANSFEU undertakes to deliver both a reliable toxicity measurement methodology and a holistic fire safety approach for all kind of surface transport (trains, vessels, etc.). It will be based on a harmonized Fire Safety Engineering methodology which will link passive fire security with active fire security mode.
Transfeu Process

**Fire Safety Engineering (FSE)**
Application of engineering principles, rules, and expert judgement based on a scientific appreciation of fire phenomena, of the effects of fire, and of the reaction and behaviour of people, in order to:

a) Save life,
b) Protect property and preserve the environment and heritage,
c) Quantify fire hazards, fire risks, and the effects of fire,
d) Evaluate analytically the optimum protective and preventative measures necessary to limit, within prescribed levels, the consequences of fire.
Transfeu Process

First step:
Definition of scenarios. (WP4)
Scenario for Commuter train
Scenario for single deck operation category 2 (category A TSI SRT)
### Transfeu Process

#### Workpackage 4, Fire scenario 1A
Commuter Train, Operation category 1

<table>
<thead>
<tr>
<th>Location</th>
<th>Open passenger area (150m³) no evacuation to adjacent vehicle.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attributes describing the fire scenario</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Ventilation conditions during fire impact | HVAC : Is in function during the dwell time  
Natural : 3 open doors after 40 seconds.  
Maximum Air flow : max 0.5 m³/s injected by the ceiling |
| Ignition sources | Applicable Fire model 5 according TS 45545-1.  
Located where the luggage can be placed :  
On the floor between the seats close to the wall |
| Fire detection | No detection |
| Fire protection (effects time based) | HL 1 Material |
| Fire control according mitigation measures | No fire control mitigation |
| Evacuation measures | Evacuation distance is not more than 6 m  
Total Passenger in the area : 75 |
| Geometrical measurement 3D | |
| RSET Requested safe escape time is (min) (Dwell time) | 2 |
| Heat radiation | Time after ignition reaching at any point on the evacuation routes the heat radiation of 4 kWm-2 (ISO 13571 Thermal dose) |
| Extinction coefficient | < 0.5 m-1 ISO 5659-1 on agreed height of 1.5 m |
| Toxic fumes | 2 min time after ignition reaching the summation of CIT <1 |
Transfeu Process

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>Workpackage 4 Fire scenario 1B Single deck Operation Category 2 (Cat A TSI SRT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributes describing the fire scenario</td>
<td>Open passenger area (150m³) no evacuation to adjacent vehicle.</td>
</tr>
</tbody>
</table>
| Ventilation conditions during fire impact | HVAC : is in function during the dwell time  
Natural : 3 open doors if the train is stopped after 4 min  
Maximum Air flow : max 0.5 m³/s |
| Ignition sources | Applicable Fire model 5 according TS 45545-1. Located where the luggage can be placed:  
On the floor between the seats close to the wall |
| Fire detection | No detection |
| Fire protection (effects time based) | HL 2 Material |
| Fire control according mitigation measures | No fire control mitigation |
| Evacuation measures | Evacuation distance is not more than 6 m  
70 Passengers in the passenger area |
| Geometrical measurement 3D | Requested safe escape time is (min) |
| RSET | 6 |
| Heat radiation | Time after ignition reaching at any point on the evacuation routes the heat radiation of 4 kWm⁻² (ISO 13571 Thermal dose) |
| Extinction coefficient | < 0.5 m⁻¹ ISO 5659-1 on agreed height of 1.5 m |
| Toxic fumes | Time after ignition reaching the summation of CIT < 0.9 |
**Transfeu Process**

**Second Step:**
Development of a small scale test method to measure the type and quantity of toxic gases produced during the combustion of products used in transport in a dynamic procedure. This method will be used for the classification of products that reach the incapacitation and lethality thresholds in the specific scenarios in WP4 for railway vehicles.

Development of new test method for the continuous toxic gas analysis (WP2)
Transfeu Process

**Third Step**: An example of FSE: lighting diffuser

Requirements for lighting diffuser in pr EN 45545 (2010) is requirement R3 in Table 4 of part 2.

A common product is a polycarbonate device. This device don’t fulfill R3 requirement. FSE is needed.
Scenario 1A – Visual aspects

- $t = 0$
- $t = 40$ s
- $t = 2$ min
- $t = 8$ min
- $t = 9$ min
- $t = 10$ min
Scenario 1A – Visual aspects

t = 0

t = 40 s

t = 2 min

t = 8 min

t = 9 min

t = 10 min
Conclusion

• Fire Safety Engineering is a very powerful concept including many aspects as small scale test, full scale test, real scale test, modeling. It has to be improved to provide more flexible and economic solutions than the current approach.
Thank you for your attention