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Parallel Session E.1

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The experimentations on high speed rail

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The experimentations on high speed rail

Domains where experimentation is fundamental for high speed rail :

1. Approval of new high speed rolling stock on an existing already approved high speed lines

2. Approval of new or upgraded high speed lines with already approved high speed rolling stock

3. Approval of new or upgraded high speed lines with new high speed rolling stock

4. Research and developments on high speed systems

The experimentations on high speed rail

1. Approval of new high speed rolling stock on existing approved high speed lines

Generally speaking the approval of new high speed rolling stock requires a big amount of experimentation.

In Europe requirements for high speed trains to be verified by means of full-scale tests are held in:

- TSIs
- European norms
- National rules
- Contractual requirements

Large experimental campaigns and full-scale testing are required to verify that high speed trains meet these requirements.

The experimentations on high speed rail

1. Approval of new high speed rolling stock on existing approved high speed lines

TSIs essential requirements for rolling stock:

- safety
- reliability and availability
- health
- environmental protection
- technical compatibility

Fundamental full-scale tests to carry out on high speed trains:

- dynamic behaviour and passenger comfort
- braking performances
- aerodynamic behaviour and quality of current collection
- exterior noise and electromagnetic interference
- signalling

The experimentations on high speed rail

1. Approval of new high speed rolling stock on existing approved high speed lines

Example:
Approval of Dual Voltage ETR 500 on RFF high speed network:

The approval consists of the two phases:

1. **verification of the technical documentation regarding design, manufacturing and operations**
2. **performing the full-scale tests on conventional and high speed lines**

Phase 1 started in 2000 and will be completed in 2006.
Phase 2 started in 2004 and will be completed in 2006.
Main test campaign carried out or in progress:

- **braking performances**
- **aerodynamic behaviour and quality of current collection**
- **signalling**
- **dynamic behaviour**

2. Approval of new or upgraded high speed lines with high speed rolling stock already approved on a HSL

TSIs essential requirements for infrastructure:

- safety
- reliability and availability
- health
- environmental protection
- technical compatibility

The approval procedure is requires a large utilization of full-scale test campaign on ground and on trains.

One or more "instrumented" high speed trains - approved on a similar high speed line - are the best option. In addition a large set of quasi-static measurements are to be carried out on the track and on the catenary by the diagnostic trains or by the infrastructure measuring cars.

2. Approval of new or upgraded high speed lines with high speed rolling stock already approved on a HSL

For the approval procedure an approach combining quasi-static and dynamic tests is necessary.

Standard test procedure:

- **quasi-static tests up to : 160 km/h**
- **dinamyc tests up to: V_{line} + 10%**

Fundamental test campaigns to carry out on high speed lines:

- **dynamic verification**
- **catenary measurements and quality of current collection**
- **aerodynamic effects in tunnels and in open air (i.e. flying ballast)**
- **signalling**

2. Approval of new or upgraded high speed lines with high speed rolling stock already approved on a HSL

Main critical aspects to perform the test campaign for the approval of high speed lines:

- **availability of high speed test trains;**
- **cost of the test campaigns.**

3. Approval of new or upgraded high speed lines with new high speed rolling stock

This type of approach has been followed for many new lines with the aim to reduce costs and duration of the approval or to achieve the approval either of new train and new line.

However this approach should be avoided (it is not “correct”).

In addition it is linked to high risk to cause significant delays in the progress of the approval (for example if it occurs a problem caused by the interaction of infrastructure and rolling stock).

3. Approval of new or upgraded high speed lines with new high speed rolling stock

When an "incorrect" approach is necessary?

In the case of entering of new technologies working or having effects on the whole system.

Examples of this scenario :

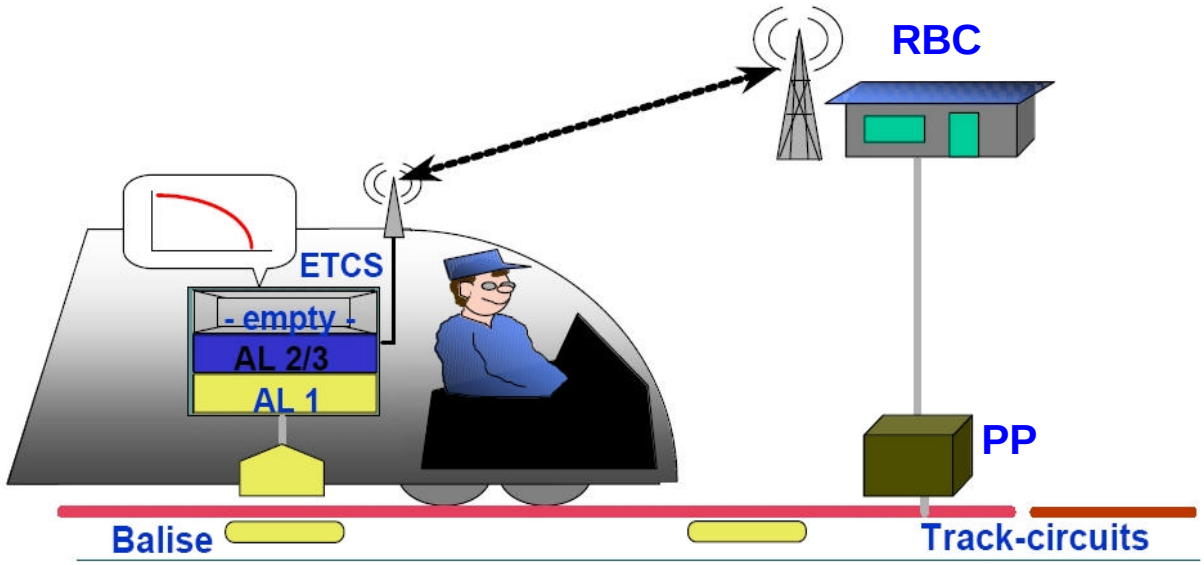
- **approval of new signalling systems;**
- **approval of operations at high cant deficiency with new tilting trains.**

In this case the verifications have to be carried out both on trains and on the infrastructure. It is essential to measures the parameters related to safety and to the interfaces (wheel-rail forces, signalling, catenary parameters, etc.).

3. Approval of new or upgraded high speed lines with new high speed rolling stock

Examples: **Tests of ERTMS/ETCS Level 2 on the new HSL Roma-Napoli and on the ETR 500.**

In October 2005 ERTMS level 2 has been tested up to 350 km/h.



Test scheduling

- **2001-2003: laboratory tests**
- **2003-2005: line tests on trial sites**
- **2005: test-runs with ETR500 trains**
- **12/2005: operation starting**

4. Research and developments on high speed systems

Simulation methods are the most powerful and the less expensive tools to undertake research projects on high speed systems. Anyway experimentation is necessary to provide data to validate numerical tools and to certify the results predicted by simulations.

The five main research priorities in EU programme :

- **interoperability**
- **intelligent mobility**
- **safety and security**
- **environment**
- **innovative materials and production methods**

4. Research and developments on high speed systems

Main aspects to investigate for the next generation of HST by means of experimentation within research programmes:

- **aerodynamics (drag, flying ballast, cross wind effects on safety, pressure wave reduction in tunnels);**
- **aerodynamic noise (nose, bogie, inter-car gap, pantograph);**
- **active controlled pantographs for current collection optimisation;**
- **light-weight technologies (new materials and innovative design and production methods);**
- **passenger comfort and dynamic behaviour;**
- **energy consumption performances;**
- **braking systems independent from adhesion.**

Conclusions

Results and potentialities of experimentation on high speed rail:

- **experimentation is necessary and is required in the process of approval of new high speed trains, new high speed lines and new high speed technologies;**
- **extensive test campaigns have been carried out for the approval of the new lines and trains; under test conditions very high speeds have been explored and the possibility of operations at speeds higher than the current ones has been clearly shown;**
- **anyway the priority in Europe, focused also by EU research programme, is not to increase the speed but to extend as much as possible the European high speed system by a connected high speed network and interoperable trains.**