and the Homologation of a Low Noise Brake System with LL Brake Blocks

UIC Presentation, May, 28th 2013
Johannes Gräber, DB Systemtechnik, UIC Project Manager EuropeTrain
The basic principle for a noise reduction at the source (wheel/rail-contact) is very simple: “Smooth wheels on smooth rails”

- Basic principle: „Smooth wheels on smooth rails “

- With the use of composite brake blocks in combination with smooth rails the pass-by (rolling) noise is reduced by approximately 10 dB (A), which means a halving of the felt noise

- Two technical solutions are available with type K or LL

- With K blocks a proven and fully homologated technology is available for new wagons – but not economically feasible for retrofitting due to high effort and cost

- The final homologation of LL brake blocks for a quick and affordable retrofitting of the existing fleet is done
UIC member’s money spent so far on the development of composite brake blocks now led to the final goal – the Homologation of LL blocks

Provisional Certification of K - blocks  System Approval of K - blocks

System Approval of LL - blocks

Provisional Certification of LL - blocks  Synthesis Report LL-blocks B126 RP 36

Study on Equivalent Conicity

EU-funded projects


EU-cer/uir – Program „Noise reduction of freight wagons through composite brake blocks“

UIC member’s money spent so far on the development of composite brake blocks now led to the final goal – the Homologation of LL blocks

UIC/CER/UIP – Program „Noise reduction of freight wagons through composite brake blocks“

System Approval of K - blocks

Provisional Certification of LL - blocks
The path of the EuropeTrain was defined in different Loops, each representing certain operational, topographic and/or meteorological conditions

- A Train with about 30 representative wagons which runs throughout Europe only for the in-service testing of LL brake blocks
- Duration of testing at least one year including all climatic conditions
- Mileage to be achieved at least 200,000 km
- All operational conditions relevant for Europe have to be covered, e.g. running on different gradients with different operational modes, arctic winter areas, high temperature zones

<table>
<thead>
<tr>
<th>Loop</th>
<th>Description</th>
<th>Runs Planned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loop 1</td>
<td>Winter flat loop (Scandinavian loop)</td>
<td>2 runs</td>
</tr>
<tr>
<td>Loop 2a</td>
<td>Summer flat loop (French loop)</td>
<td>4 runs</td>
</tr>
<tr>
<td>Loop 2b</td>
<td>Summer flat loop (German Rhine valley loop)</td>
<td>2-3 runs</td>
</tr>
<tr>
<td>Loop 3</td>
<td>Transalpine loop (winter and summer conditions)</td>
<td>3-4 runs</td>
</tr>
<tr>
<td>Loop 4</td>
<td>Eastern loop</td>
<td>2-3 runs</td>
</tr>
<tr>
<td>Loop 5</td>
<td>Summer mix loop (Italian loop)</td>
<td>2 runs</td>
</tr>
<tr>
<td>In total</td>
<td>Approx. 200,000 km</td>
<td>16 runs</td>
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</tbody>
</table>
The operation of EuropeTrain was finished successfully with an overall mileage of more than 200,000 km. The results are very promising.

<table>
<thead>
<tr>
<th>No.</th>
<th>Start Date - End Date</th>
<th>Loop Description</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>06.12.10 - 06.01.11</td>
<td>Scandinavian loop - Sweden</td>
<td>✔</td>
</tr>
<tr>
<td>2</td>
<td>27.01. - 11.02.11</td>
<td>Summer flat loop - Germany</td>
<td>✔</td>
</tr>
<tr>
<td>3</td>
<td>26.02. - 17.03.11</td>
<td>Summer flat loop - France</td>
<td>✔</td>
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<tr>
<td>4</td>
<td>07.04. - 29.04.11</td>
<td>Eastern loop - Poland</td>
<td>✔</td>
</tr>
<tr>
<td>5</td>
<td>14.05. - 01.06.11</td>
<td>Transalpine loop - Switzerland</td>
<td>✔</td>
</tr>
<tr>
<td>6</td>
<td>17.06. - 17.07.11</td>
<td>Summer mix loop - Italy</td>
<td>✔</td>
</tr>
<tr>
<td>7</td>
<td>30.07. - 23.08.11</td>
<td>Summer flat loop - France</td>
<td>✔</td>
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<tr>
<td>8</td>
<td>06.09. - 26.09.11</td>
<td>Transalpine loop - Austria</td>
<td>✔</td>
</tr>
<tr>
<td>9</td>
<td>15.10. - 06.11.11</td>
<td>Eastern loop - Poland/Slovakia</td>
<td>✔</td>
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<tr>
<td>10</td>
<td>26.11. - 16.12.11</td>
<td>Winter flat loop - France loop</td>
<td>✔</td>
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<tr>
<td>11</td>
<td>20.01.12 - 07.02.12</td>
<td>Winter mix loop - Germany/Switzerland</td>
<td>✔</td>
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<tr>
<td>12</td>
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<td>Scandinavian Loop - Sweden</td>
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<tr>
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<td>Summer flat Loop - Germany</td>
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<tr>
<td>14</td>
<td>28.05.12 - 14.06.12</td>
<td>Summer flat Loop - France and Luxembourg</td>
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<tr>
<td>15</td>
<td>06.07.12 - 05.08.12</td>
<td>Summer Loop - Italy</td>
<td>✔</td>
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<tr>
<td>16</td>
<td>01.09.12 - 20.09.12</td>
<td>Summer mix Loop - Austria/Hungary</td>
<td>✔</td>
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In total Approx. 200,000 km

Final report – completed by end 2012
27 Railways and 8 Industry Partners supported the Project

<table>
<thead>
<tr>
<th>Austria</th>
<th>Belgium</th>
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<th>Czech Republic</th>
<th>Denmark</th>
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<tbody>
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<td>NRIC</td>
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<td>Zukunft am Zug</td>
<td>Right On Track</td>
<td>NATIONAL RAILWAY INFRASTRUCTURE COMPANY</td>
<td>Swiss Federal Railways</td>
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<table>
<thead>
<tr>
<th>Finland</th>
<th>France</th>
<th>Germany</th>
<th>Hungary</th>
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<td>Réseau Ferré de France</td>
<td>DB Mobility Networks Logistics</td>
<td>EMÁV</td>
<td>Ferrovie Italiane</td>
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<th>Norway</th>
<th>Poland</th>
<th>Portugal</th>
<th>Romania</th>
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<td>ProRail</td>
<td>Jernbaneverket</td>
<td>PKP</td>
<td>CP</td>
<td>CFR Marfa</td>
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<tr>
<th>Serbia</th>
<th>Slovakia</th>
<th>Slovenia</th>
<th>Sweden</th>
<th>Switzerland</th>
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<tbody>
<tr>
<td>JIR</td>
<td>ŽSR</td>
<td>Slovenske železnice</td>
<td>green cargo</td>
<td>AAE</td>
</tr>
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<tr>
<th>SBB CFF FFS</th>
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4 Manufacturers of Brake systems and Brake blocks supported the project with considerable financial contributions

- Faiveley Transport
- Knorr Bremse
- ICER Brakes
- Wabtec (Becorit / CoFren)
Conclusions and Perspective of EuropeTrain

The conclusions summarized in the Synthesis Report LL – B 126 RB 36, were also confirmed by the results of EuropeTrain:

- The requirements regarding braking are fulfilled.
- The thermal burden on the wheels is uncritical by following the rules defined in the „Usage guidelines for composite (LL) brake blocks”.

Perspective for the final Homologation based on the results of EuropeTrain:

- LL-block products are available to be homologated
- The Homologation can be finalized taking into account operational constraints
- The operational constraints are related to regularly inspections of the wheel profiles and possibly reprofilations. The new, less extensive intervals and limit values were derived from the very positive results of EuropeTrain.
And now a quick look into the workshop
Continuous and Stationary measurements in EuropeTrain

Stationary measurements and activities in Minden:
- Running behaviour measurement
- Running behaviour analysis
- Brake technology measurement
- Brake technology analysis
- Measurement exchange
- Reloading

Continuous measurements of accelerations on the train:

DB AG
The mean values of wheel wear and block durability show the same tendency as in other in-service tests.

Relative wear rates:
- Run 4 - PL loaded: 420
- Run 5 - CH loaded: 837

Absolute values cast iron:
- Block wear 56 mm / 100,000 km
- Wheel wear (Sh) 0.80 mm / 100,000 km

Diagram: all wagons (unloaded and loaded), all runs

Please note: Block and wheel wear is varying much between the different loops and conditions (see examples). Therefore the EuropeTrain project also provides a huge amount of raw data for further LCC analyses.
Overall Results regarding the evolution of Equivalent conicity
- Situation at the beginning of EuropeTrain - schematic -

![Graph showing equivalent conicity evolution over mileage]

- Known characteristic with cast iron brake blocks
- LL-blocks extreme
- LL-block with narrow flange

Final mileage of EuropeTrain
LL brake blocks in EuropeTrain show an increase of equivalent conicity near the lower limit of the schematic diagram.

Exemplary results from EuropeTrain for C 592-1

New, increased limit value proposed on the basis of UIC 518 tests

Final mileage of EuropeTrain

Real LL values from EuropeTrain
LL brake blocks in EuropeTrain show an increase of equivalent conicity near the lower limit of the schematic diagram.

Exemplary results from EuropeTrain for IB 116*

New, increased limit value proposed on the basis of UIC 518 tests

Final mileage of EuropeTrain

real LL values from EuropeTrain
Decisions of UIC regarding the final Homologation of LL brake blocks are published in two documents

Conclusions / Recommendations:
- C 952-1 and IB 116* are available to be homologated
- Regulations regarding the monitoring of the wheel profiles can be adapted
  ➔ see proposal for revision of the usage guideline

1.3 Approved composite (LL) brake blocks - types and use

See Appendix M3 to UIC leaflet 541-4, 4th edition “fully certified products”.

Published for UIC internal use
Published on public UIC website since May, 1st 2013
Published on public UIC website soon
Time table Homologation of LL brake blocks / Retrofitting with LL-blocks

EuropeTrain operation till Sept. 2012
Decision UIC Committees
Homologation of LL-blocks 2013
Starting of Retrofitting

- EuropeTrain will deliver results, that will also be analysed regarding eq. conicity
- The results are the basis for a possible homologation

Decision UIC Committees
- SET 07 (Brakes)
- SET 06 (Wheels)
- TTI (equivalent conicity)
- RSF

Revised ERA Technical document 2

- Production speed up
- Preparing retrofit
- Retrofit

Timetable for preparation of production and retrofit with LL-brake blocks

May 2013
June 2013
Summarizing with some facts and figures

- The STAIRRS project demonstrated that **reducing noise at the source** by retrofitting freight rolling stock with low noise braking technology to ensure smooth wheel surfaces is the most cost effective option, and that this is far more cost-effective than constructing noise barriers, since it avoids high investments and maintenance cost for infrastructure managers.

- With K blocks a proven and fully homologated technology is available for **new wagons** – but not economically feasible for retrofitting due to high effort and cost (approx. 2,000 – 10,000 € per wagon).

- Considering a fleet of 350,000 freight wagons in Europe **retrofitting with LL blocks** will significantly reduce the retrofitting cost from ca. 1,8 Billion € to ca. 450 Million €.

- UIC spent so far **about 15 Million €** on the whole development process for K and LL brake blocks.
For Questions and Suggestions I’m at your disposal

For further information:

>>> [http://EuropeTrain.uic.org](http://EuropeTrain.uic.org) <<<

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