The European qualification system for road traffic noise reducing devices

Prof. Massimo Garai - University of Bologna, Italy

Introduction
Noise reducing devices (NRD’s) types

- Noise barriers
- (Absorptive) Claddings
- (Road) Covers
- Added Devices

EN standards for NRD’s

- **CEN**: European Committee for Standardization
- **TC 226**: Technical Committee for road equipments
- **WG 6**: Working Group for noise reducing devices
- → Package of 10 standards
- → CE marking (obligatory from **01-05-2007**)

CE marking (obligatory from 01-05-2007)
EN standards for NRD’s

Harmonized with the 89/106/EEC Directive

EN 14388

Acoustic Characteristics

Non acoustic Characteristics

Acoustic durability prEN 14389-1

Intrinsic characteristics

Mechanical characteristics EN 1794-1

Environmental characteristics EN 1794-2

Non acoustic durability EN 14389-2

Absorption EN 1793-1 CEN/TS 1793-5

Insulation EN 1793-2 CEN/TS 1793-5

Intrinsic diffraction CEN/TS 1793-4

Testing: what?

- Acoustic characteristics
  - Durability!
- Non acoustic characteristics

7 April 2006 4th Portuguese Road Congress – ESTRADA 2006
Testing: when?

- **Before the installation**
  - Qualification
  - In laboratory

- **After the installation**
  - Verification
  - In situ = on the construction site

**Acoustics characteristics – Laboratory measurements**
Sound absorption (EN 1793-1)

Single number ratings from frequency dependent results

<table>
<thead>
<tr>
<th>Category</th>
<th>$DL_\alpha$, dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0</td>
<td>N.D.</td>
</tr>
<tr>
<td>A1</td>
<td>&lt; 4</td>
</tr>
<tr>
<td>A2</td>
<td>4 to 7</td>
</tr>
<tr>
<td>A3</td>
<td>8 to 11</td>
</tr>
<tr>
<td>A4</td>
<td>&gt; 11</td>
</tr>
</tbody>
</table>
Airborne sound insulation (EN 1793-2)

Single number ratings from frequency dependent results

<table>
<thead>
<tr>
<th>Category</th>
<th>$DL_R$, dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0</td>
<td>N.D.</td>
</tr>
<tr>
<td>B1</td>
<td>&lt; 15</td>
</tr>
<tr>
<td>B2</td>
<td>15 to 24</td>
</tr>
<tr>
<td>B3</td>
<td>&gt; 24</td>
</tr>
</tbody>
</table>
Normalised traffic noise spectrum (EN 1793-3)

Acoustics characteristics – In situ measurements
**Reflection index (CEN/TS 1793-5)**

$d_s = 1.5 \text{ m}, \ d_M = 0.25 \text{ m}$

---

**Reference “free-field” response**
**Sound insulation index**
(CEN/TS 1793-5)

\[ d_S = 1 \text{ m}, \, d_M = 0.25 \text{ m}, \text{ grid step } s = 0.40 \text{ m} \]

---

**Sound insulation:**
the reference measurement
The method can be applied in presence of a high background noise.

Results for the acoustic elements

\[
\text{DL}_{SI} = 32 \text{ dB (2000)} \quad \text{DL}_{SI} = 32 \text{ dB (2005)}
\]

Results near a post

\[
\text{DL}_{SI} = 33 \text{ dB (2000)} \quad \text{DL}_{SI} = 32 \text{ dB (2005)}
\]
Sound insulation: placing the microphone grid

Example of default detection

- Lab.: 45 dB (2001)
- Elem.: 37 dB (2005)
- Post: 20 dB (2005)
Diffraction index difference
(CEN/TS 1793-4)

- Measurements *with and without* the added device
- The difference is an *intrinsic* result
- The wall is treated to be 1) *reflective*, 2) *absorptive*

Non acoustics characteristics – Laboratory measurements
Simulated wind load (EN 1794-1)

Loading the element with structural steel sections and measuring the deflection or reporting the failure!

Impact of stones (EN 1794-1)

Stones may be thrown up from the road by cars

Hardened steel striker

Impact energy = 30 ± 1 J
Impact of stones: some results

Yes

No
Resistance to brushwood fire (EN 1794-2)

two wire mesh baskets containing shavings of spruce

Fire damage after an accident occurred in 2003

gasoline fire is very different from brushwood fire!
Risk of falling debris (EN 1794-2)

- in case of severe impact:
  - dangerous debris
  - panel detachment
- → restraint systems may be necessary
- test using a pendulum impactor (6 kJ or 0.5 kJ)

Environmental protection (EN 1794-2)

- identify products or constituent materials that could have with time adverse effects on the environment
  - under natural exposure
  - in case of fire
- identify products or constituent materials that could be recycled
Light reflection (EN 1794-2)

- smooth surfaces
- depending on the angle of incidence
- danger of disability glare for drivers
- specific of products and site conditions
- reflectivity tested according to ISO 2813

Transparency (EN 1794-2)

- static for people living behind the NRD (aesthetic reasons)
- dynamic for road users (contributes to traffic safety)
- harmonised method of calculation provided
Durability or Long term performance

The manufacturer shall declare the estimated reduction in the acoustic performance (single number ratings) of the noise reducing device after 5, 10, 15 and 20 years service in given exposure classes.
**Durability (non acoustic)**

Fixed period of time during which the performance of the device will be maintained which enables it to fulfil the **performance characteristics** as identified in EN standards.

- **Structural** elements (e.g. posts): 30 years
- **Acoustic** elements (e.g. panels): 15 years

---

**Conclusions**

- Relevant **laboratory** and **in situ** measurements are now standardised at European level
- EN standards cover **acoustic** and **non acoustic** properties
- **Long term durability** must be assessed
- Noise reducing devices can get a **CE mark**
- The package of EN standards helps in selecting the most suitable noise reducing devices for roads and railways