Low-noise road surfaces in Switzerland

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Noise situation in Switzerland

• Traffic causes noise and effects health negatively

• Road traffic is the most important source of noise

• The sound of rolling wheels is the main cause of traffic noise
Legal framework in Switzerland

- **Environmental Protection Law**
  - Priority for noise abatement at the source

- **Federal noise protection regulation**
  - Limits on exposures
  - Road owners (confederation, cantons, municipalities) are obliged to carry out noise reduction

- **Federal Office for the Environment FOEN**
  - Federal Noise Abatement Agency
  - Periodic survey on the status of noise reduction

- **Federal Roads Office FEDRO**
  - Owner of the national roads
  - Responsible for noise reduction on national roads

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Low-noise road surfaces in Switzerland

Federal Roads Office FEDRO
Basic approaches to noise abatement in Switzerland

- **Principle: Combat noise at the source**
  1. reduce emissions
  2. measures on the propagation path - noise barriers
  3. measures at the point of immission – soundproof windows

- **Urban roads**
  - Low-noise road surfaces have a high reduction potential
  - Measures in the propagation path only applicable to a limited extent

- **National roads / roads outside urban areas**
  - Low-noise road surfaces are of great relevance
  - Noise barriers, overpasses and tunnels are expensive but also effective measures
Traffic noise and noise perception

- A noise reduction of -3 dB corresponds to halving of the traffic volume.

- A noise change of +/- 3 dB can just be perceived by the human ear.

- Noise changes of +/- 10 dB are perceived by humans as a doubling / halving of the noise level.
Low-noise road surfaces

Challenges

Useful life of national road ≥ 15 years

Useful life of national road < 10 years

Noise reduction

Service life

Air void content

dense surface MA, SMA

porous surface PA

< 10 years

up to 25 years

optimaler Bereich
Research and development
Low-noise road surfaces

Low-noise road surfaces in urban areas
(long-standing cooperation between FEDRO + FOEN)

• Status report 2003
• Report 2007
• Research Package
  Final report 2017

Low-noise road surfaces on national roads

• FEDRO promotes the development of low-noise surfaces, especially for highly congested motorways through research and pilot projects
Goals of the research package
- Promoting acceptance - achieving win-win
- Supporting cantons and municipalities

Joint management by FEDRO and FOEN

3 Subprojects
- Research
- Test tracks
- Monitoring test tracks
Research package on low-noise surfaces in urban areas

- **8 Research projects**
  * Laboratory methods
    (formulations, durability, noise properties)
  * Acoustic measurement methods
  * Operation and maintenance (categorisation, cleaning)
  * Variability of surface production
  * Innovations (international)

- **15 Test sections**
  Production with innovative asphalt mixtures

- **Long-term monitoring**
  Measuring and documenting the development of technical and acoustic properties
Research package
Low-noise surfaces in urban areas

Knowledge gained and initiated developments

- **Origin of rolling wheel noise**
  - Vibrations and contact points
  - Surface structure
  - Corresponding cavities

- **Semi-dense road surfaces SDA**
  (void content 12% to 20%)
  for noise reduction on Urban roads

- **Symposium in September 2017**
Low-noise surfaces 2021 - Principles

Permanent noise-reducing surfaces standards for all roads
(Standard VSS 40 425)

For comparison:
level value for non-low-noise "stone matix asphalt" (SMA 11)

Model covering for Swiss calculation model (STL-86+)

Level reduction at the end of the acoustic service life (10-15 years)

<table>
<thead>
<tr>
<th>Category</th>
<th>state of the art</th>
<th>Level change after installation</th>
<th>Level change after 5 years</th>
<th>Level change at the end of the acoustic service life</th>
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</thead>
<tbody>
<tr>
<td>II</td>
<td>Success promising</td>
<td>-6</td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td>I</td>
<td>Proven</td>
<td>-3</td>
<td>-1.5</td>
<td>-1</td>
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</table>
Low-noise surfaces - International evaluation

Value for SMA 11 according to Swiss calculation model (STL-86+)

Reference: Surfaces essentially corresponding to a stone mastix asphalt (SMA 11)
Semi-dense asphalt mixture (SDA) for low-noise road surfaces on all roads (Standard VSS 40 436)

<table>
<thead>
<tr>
<th>Variety and class</th>
<th>-12</th>
<th>-16</th>
<th>-20</th>
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<tbody>
<tr>
<td>volume %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDA 4</td>
<td>12</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>SDA 8</td>
<td>12</td>
<td>16</td>
<td></td>
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Limits for the void content of Marshall specimens

<table>
<thead>
<tr>
<th>Variety and class</th>
<th>10 ... 14</th>
<th>14 ... 18</th>
<th>18 ... 22</th>
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<tr>
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<td></td>
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Characteristic void content / void content limits

![Graph showing void content and limits for SDA 4 and SDA 8]
Low-noise surfaces in urban areas - 2021

Practices and experiences

- Application of SDA surfaces is state of the art
  * SDA 4 for high noise reduction
  * SDA 8 for high traffic loads

- Initial noise reduction -3 dB is achieved
  SDA 4 achieves up to -6 dB

- Recommendations for paving
  Trial paving / no night paving (light conditions) / no paving in adverse weather conditions / no manholes and structure markings in the rolling lane

- Challenge
  Optimization of acoustic and surface durability

- Best Practice List of the FOEN [Low-noise road surfaces (admin.ch)]
Low-noise road surfaces on national roads - 2021

- Standard SDA 8 / Type 12
  * -1 dB after 15 years
  * Service life ≥ 15 years

- Sections with high noise pollution possible in exceptional cases
  PA  * porous asphalt surface on motorways
       * -3 dB after 10 years possible
       * shortened service life < 15 years
  SDA 4  * on two-way roads
       * -3 dB - expected value after 10 years
       * shortened service life < 15 years
Low-noise road surfaces on national roads - 2021

- MA 8 LA on bridges
  * low-noise mastic asphalt surface
  * Developed by FEDRO
  * -3 dB to -5 dB after 5 years
  * Potential: permanent noise reduction + long service life

- Pilot project MA LA
  low-noise mastic asphalt on open roadways
  * Potential: low-noise + service life > 20 years
  * Research project in preparation
Challenges for the future

- Rolling wheel noise remains the main source of noise at higher speeds even with increasing e-mobility
- Human population growth
- Traffic increase

➢ Noise protection remains a permanent task

Vision

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Low-noise road surfaces in Switzerland

Federal Roads Office FEDRO
Need for research low-noise road surfaces

- Increased service life (acoustic, mechanical)
- Surfaces with maximum grain size 6 (gap closure SDA4 / SDA8)
- Optimisation of low-noise mastic asphalt
- Determination of the acoustic properties in the laboratory
- Cleaning methods for coatings SDA and PA
- Descriptive parameters
  * for the surface texture
  * for the voids
- Quantification of changes in surface texture and voids as a cause of reduction in acoustic performance
Summary

with low-noise road surfaces
an initial noise reduction
of -3 dB can be achieved

a shortened service life
on average -10 years
must be accepted