Testing methods for moisture content in concrete, dealing with floor coverings: State-of-the-Art in Finland

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Background

- Lively discussion since 1970
- Development of practical measuring since 1995
- Water vapor permeability researches in the 21’th century
- Still too much mistakes
- BePO-project with all major quarters 2005 - 2008
- Commonly accepted covering instructions in 2008
- New RT-instruction card in 2010
Proper measurements on sites

- Relative humidity
- Borehole method
- Sample method
- Measuring accuracy
- Properties of the surface structures
- Real evaluation of covering
- Shrinkage control
Redistribution of moisture profile

Water vapor tight covering

Water vapor permeable covering
Measuring depths

Intermediate floor (drying both sides)

\[ A = 0.2 \times d \]

Joint slab or slab on ground (drying one sided)

\[ A = 0.4 \times d \]

Partly pre-cast intermediate floor

\[ A = 0.2 \times d \]

Hollow Core slab + upper concrete \( (d_2) \)

\[ A = d_2 + 20 \text{ mm} \]

Hollow Core slab + screed \( (d_2) \)

\[ A = d_2 + 20 \text{ mm} \]

Dumped Hollow core + bathroom floor

\[ A = 0.4 \times d_2 \]

Always at least two depths
Maximum measuring depth 70 mm
Elastic carpets

The moisture permeability affects remarkably to the rate the moisture can diminish from the structure without causing any damage.

Moisture content just under the covering may not rise above 85 %RH

At the depth 0.4 x A the moisture content has to be under 75 %RH to allow the moisture from adhesives to absorb into the concrete.

Moisture measurement at the depth (A) at which the moisture content has to be under the covering limit. The limit can be exceeded if the depth 0.4 x A and the surface is very dry.
### Principle covering limits with carpets

<table>
<thead>
<tr>
<th>Floor covering</th>
<th>Concrete RH (%) at the depth $A$</th>
<th>Concrete and/or screed RH (%) at the surface and at the depth $0.4 \times A$</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC carpets</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Linoleum carpets</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Rubber carpets</td>
<td>85</td>
<td>75</td>
</tr>
<tr>
<td>PVC-, rubber- and linoleum tiles</td>
<td>90</td>
<td></td>
</tr>
</tbody>
</table>

- Contributors can have their own limits
- Limits can be changed according to more accurate analysis
Special covering limits

<table>
<thead>
<tr>
<th>Depth (mm)</th>
<th>Principle RH-limit (%)</th>
<th>Special RH-limit (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>75</td>
<td>80</td>
</tr>
<tr>
<td>30</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>70</td>
<td>85</td>
<td>95</td>
</tr>
</tbody>
</table>

Graph shows RH (%) vs. Depth (cm) with different lines for speed dried and normally dried materials.
Control of shrinkage

Required shape shifting ability of the surface structure when concrete dries to humidity 50 %RH after covering

Shrinkage of concrete surface after covering (mm/m)

Relative humidity in depth A during covering (%RH)
In the future

- Acceptance of only proper measurements on sites
- Water vapor permeabilities of materials better into use
- RH 85 % ≠ 3,3 p% quite often, which means that imported coverings should be taken into account more accurately.