Solutions for optimised rolling stock maintenance
1. Introduction

Mechanisms
- Bogiedesign,
- Line characteristics,
- Creepage control
- Friction management

Product
Material:
- Homogenity,
- Wear resistance,
- RCF resistance

Maintenance
- Limit values,
- Machining,
- Validation criteria, control
1. EN15313-OOR maintenance
1. EN15313-Limits

<table>
<thead>
<tr>
<th>Wheel diameter dependent speed</th>
<th>Permitted Out-Of-Rondness ($4r$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D &gt; 840$ mm</td>
<td></td>
</tr>
<tr>
<td>$v_{\text{max}} \leq 60$ km/h</td>
<td>1,5</td>
</tr>
<tr>
<td>$60$ km/h $&lt; v_{\text{max}} \leq 160$ km/h</td>
<td>1,0</td>
</tr>
<tr>
<td>$160$ km/h $&lt; v_{\text{max}} \leq 200$ km/h</td>
<td>0,7</td>
</tr>
<tr>
<td>$v_{\text{max}} &gt; 200$ km/h</td>
<td>0,5</td>
</tr>
<tr>
<td>$380$ mm $&lt; d \leq 840$ mm</td>
<td></td>
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<td>$v_{\text{max}} \leq 200$ km/h</td>
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</tr>
<tr>
<td>$v_{\text{max}} &gt; 200$ km/h</td>
<td>0,5</td>
</tr>
<tr>
<td>$d \leq 380$ mm</td>
<td>0,3</td>
</tr>
</tbody>
</table>
2. Problem: For certain trains big vibration scattering

Statistics $v_{rms}$ [mm/s] in Thun, 8m distance

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2. Problems from international review

A) Reprofiling for passenger comfort
   • Passenger coaches are more often checked and defect wheels reprofiled

B) Change of maintenance plans for vibration purpose
   • Problematic passenger coaches are measured in track and defect wheels reprofiled
   • Some problematic CARGO locomotives should have lower intervals for reprofiling (in the 1990’s)

C) Lower reprofiling intervals for better LCC
   • More reprofiling can lower LCC because of longer wheelset lifetime
3. Solutions:
Depending on the problem!

Reprofiling in Workshop
• Enough wheel lathe capacity?
• All defects taken away?

Train type
• Passenger wagon
• Problematic passenger/freight wagon
• Problematic Locos
• Freight wagon

Detection of OOR
• Limit values?
• Which measurements?
3.A Solutions: Detection of out-of-roundness

**In Workshop**
- Wheel lathe
- Automatic measurement equipment
- Manual OOR measurement equipment

**In Track**
- Automatic measurement equipment

![Diagram showing detection methods]

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3. B Solutions: Individual maintenance plans

Maintenance plans according to

- LCC calculations, taking into account positive effects of wheel lifetime
- In addition: less boogie and other defects, less interior noise, less track damage
3.C Solutions: Check of wheel lathe operations

Wheel lathe
- Proper OOR measurements before/after?
- Reprofiling technology ok?

After wheel lathe
- Check of wheels after reprofiling.
- Hidden problems under wheel tread?
3.D Solutions: Technology assessment

If the problem is severe check rolling stock construction options: See WP5 solutions!

e.g. running gear design:

<table>
<thead>
<tr>
<th>Running gear</th>
<th>Example of application</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Y25</td>
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<tr>
<td></td>
<td>DB 652</td>
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<td>U-Bahn Wien</td>
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<td>SAR</td>
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4. Conclusion

1. Measurements to understand defects is crucial

2. For LCC improvements an individual, per train type, study for maintenance optimisation is needed

3. Keep an eye on train-track mechanisms and train construction (such as boogie design, wheel material,...)
5. Next steps

1. Tests of maintenance options, CARGO Locomotive, passenger trains by vibration and dynamic force measurements (Brunnen)

2. Test report including an individual LCC analysis. (November 2013)