



# band/wegdekgeluid: mechanismen en modelvorming

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M+P Raadgevende ingenieurs bv

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## Inhoud

- Opwekking van band/wegdekgeluid
- Mechanische processen
- Aerodynamische processen
- Afstraling
- Overdracht
- Invloedsfactoren wegdek
- Modelvorming

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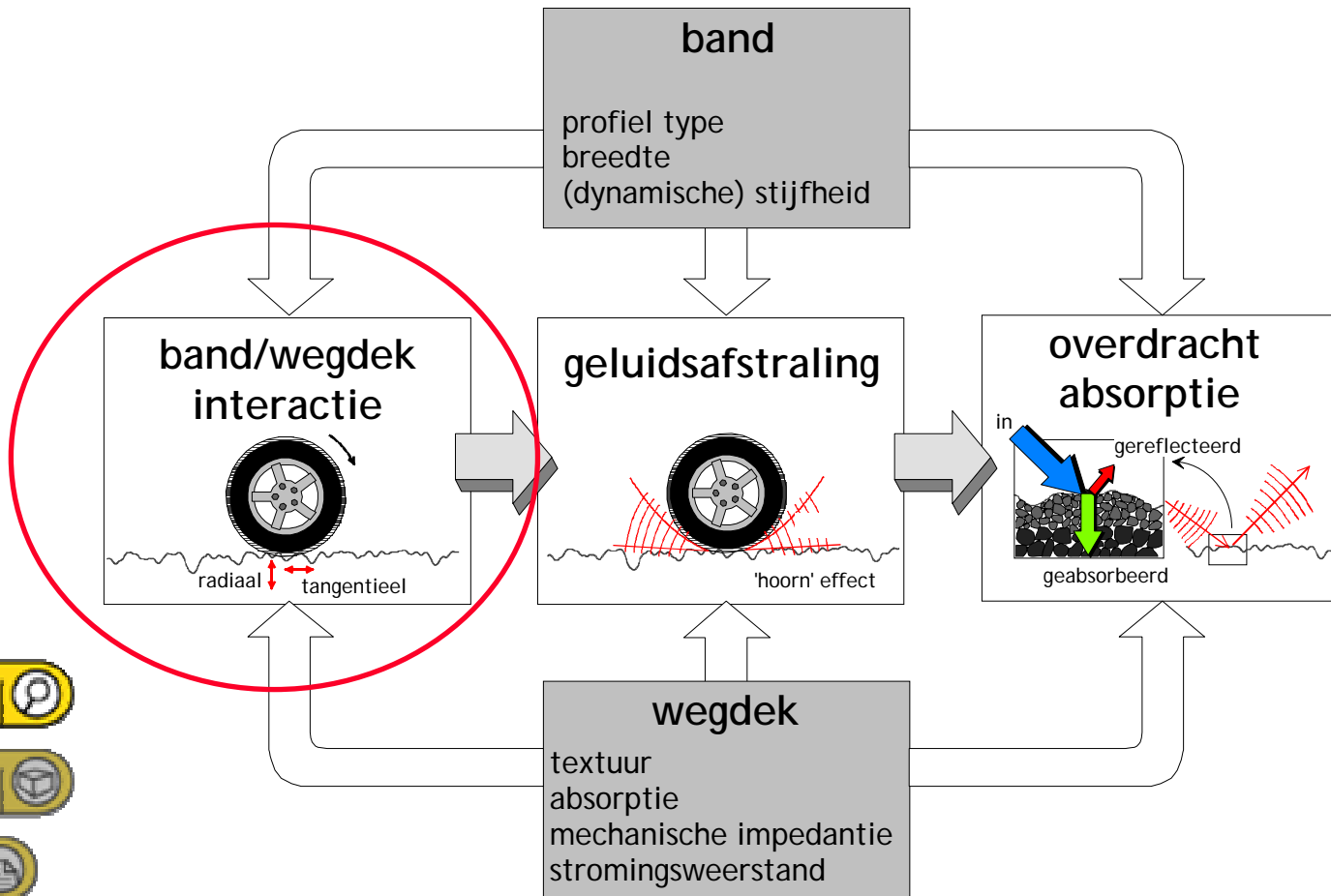
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# Opwekking band/wegdek geluid



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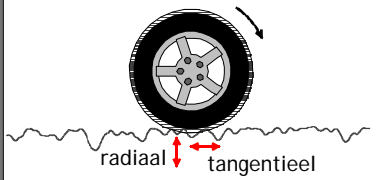
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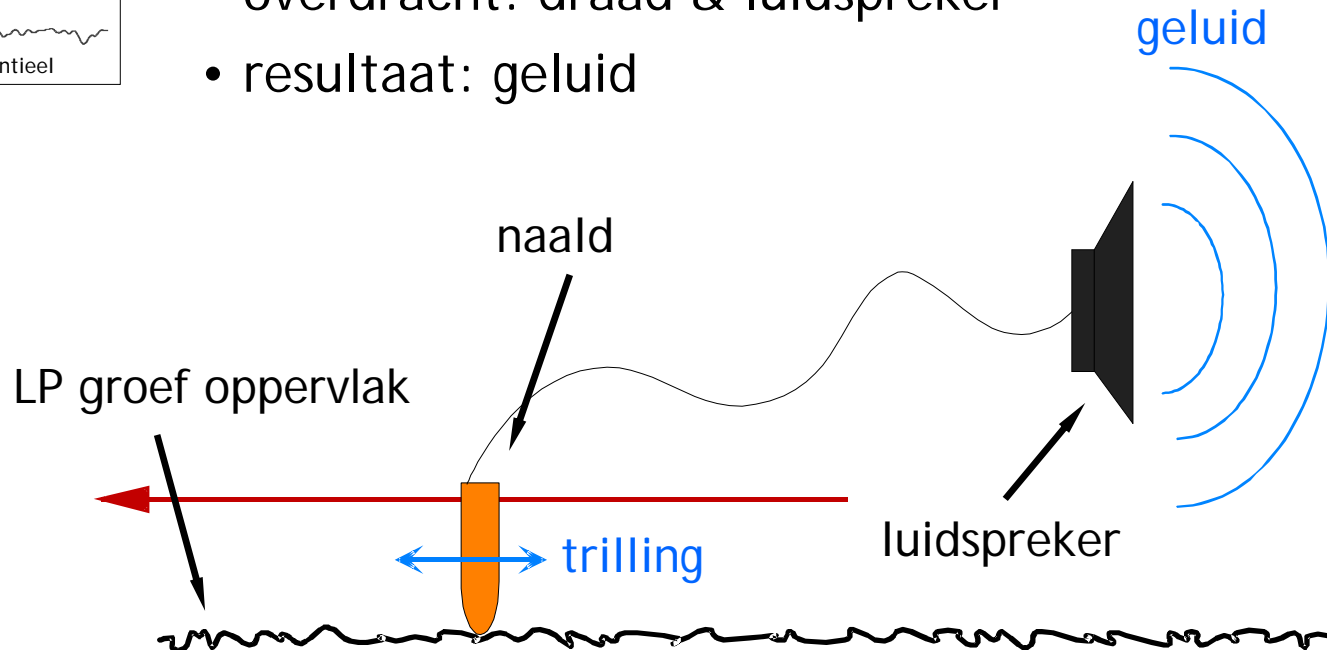


# Mechanische processen (I)

band/wegdek interactie



- Analogie: LP wordt afgetast door naald
- bron: trilling (v/d naald)
- overdracht: draad & luidspreker
- resultaat: geluid



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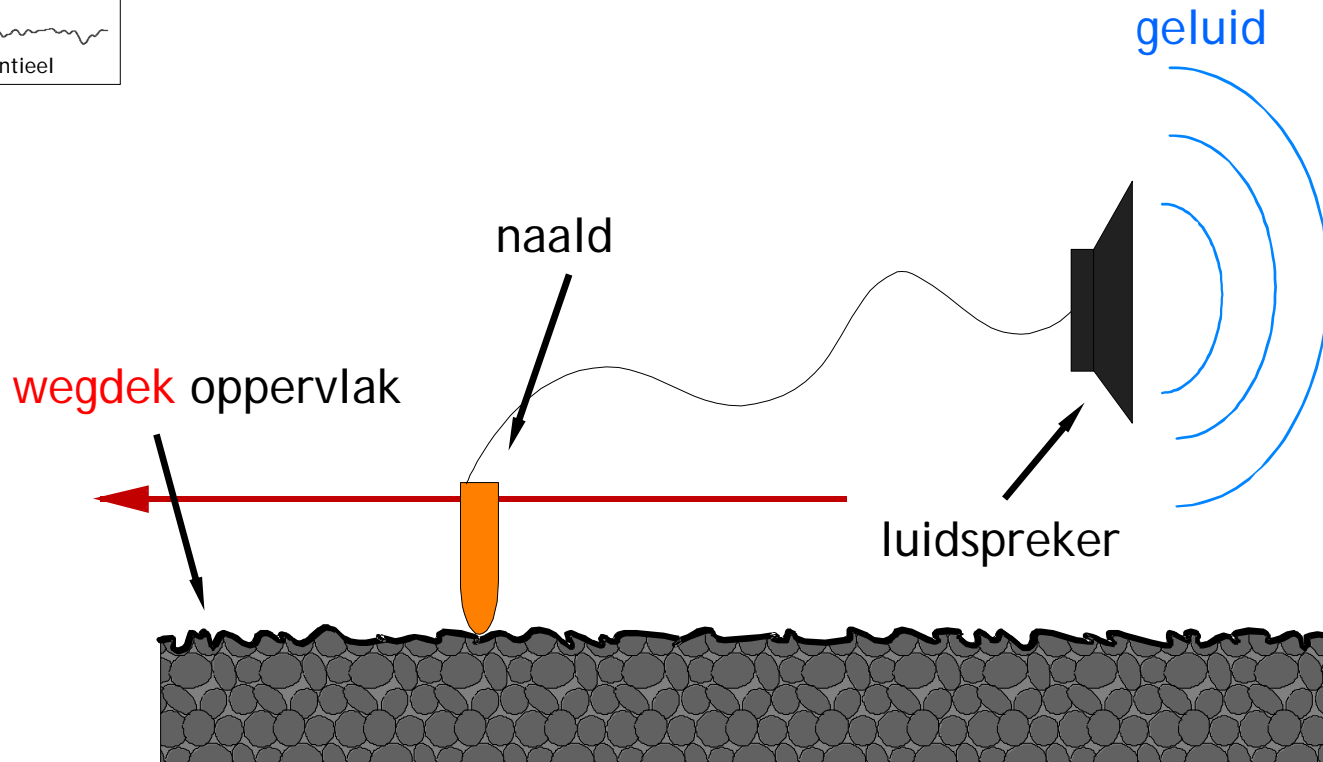
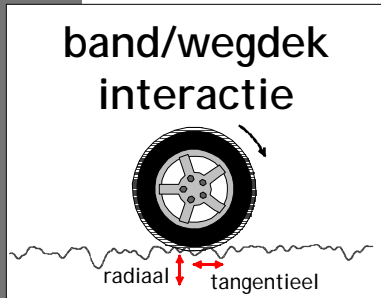
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# Mechanische processen (II)



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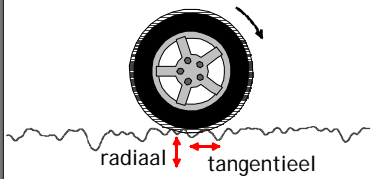
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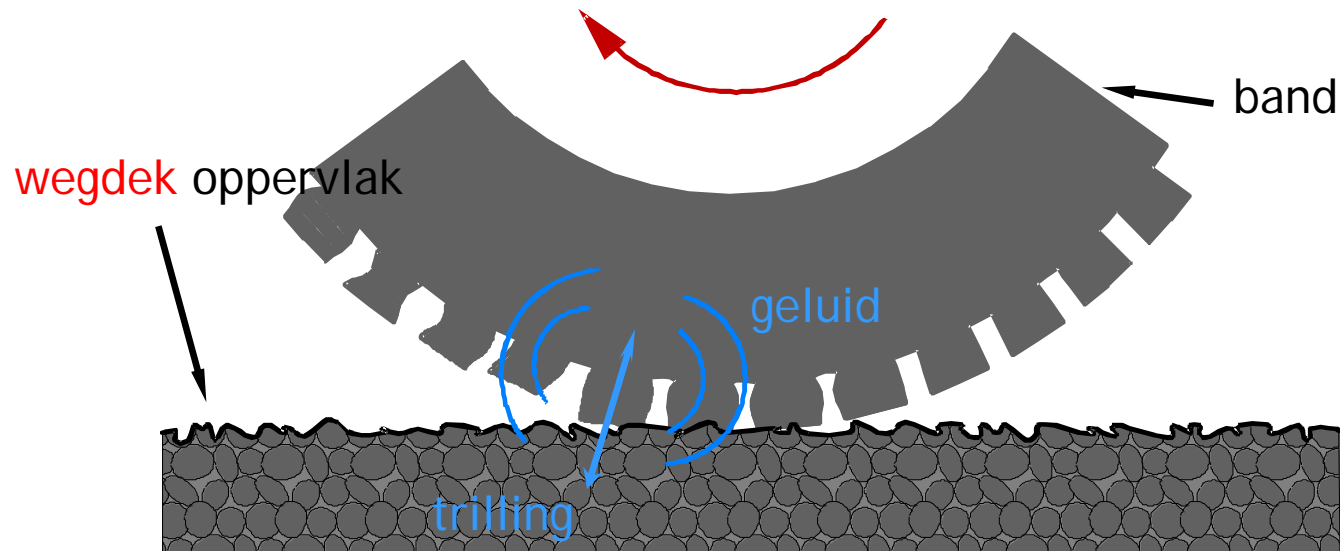


# Mechanische processen (II)

band/wegdek interactie



- wegdek oppervlak afgetast door band
- bron: trillingen in het bandprofiel
- overdracht & resultaat: band straalt geluid af



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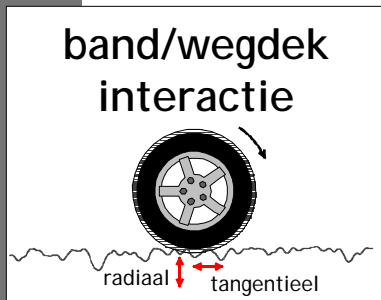
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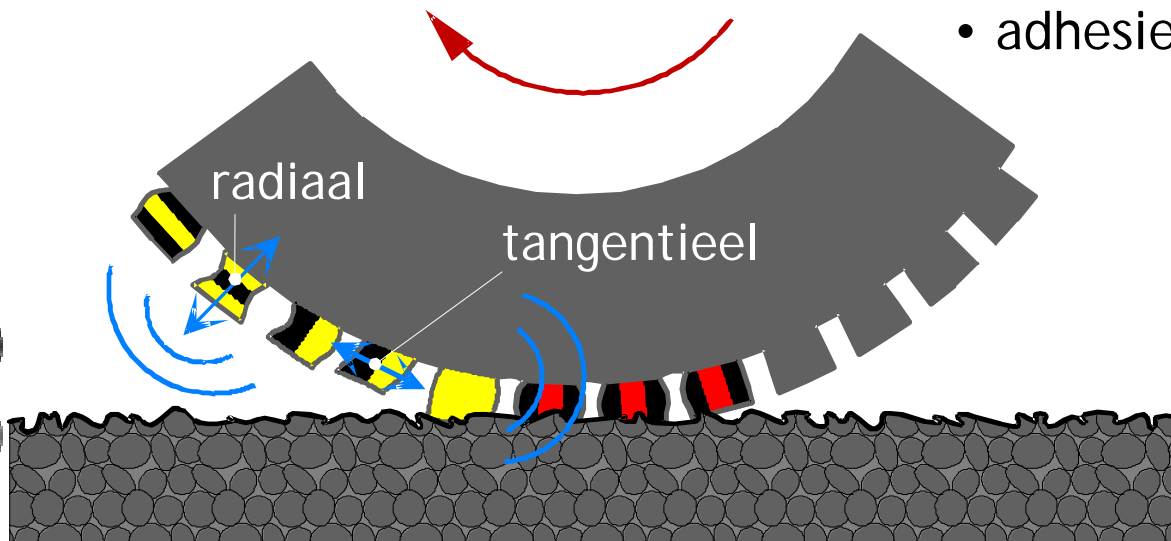
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# Mechanische processen (III)



- radiale trillingen
- tangentiële trillingen
- trillingen wang
- "stick-slip"
- adhesie ("stick-snap")



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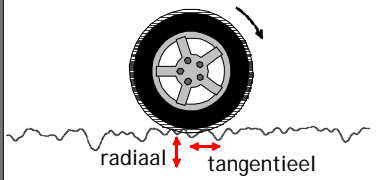
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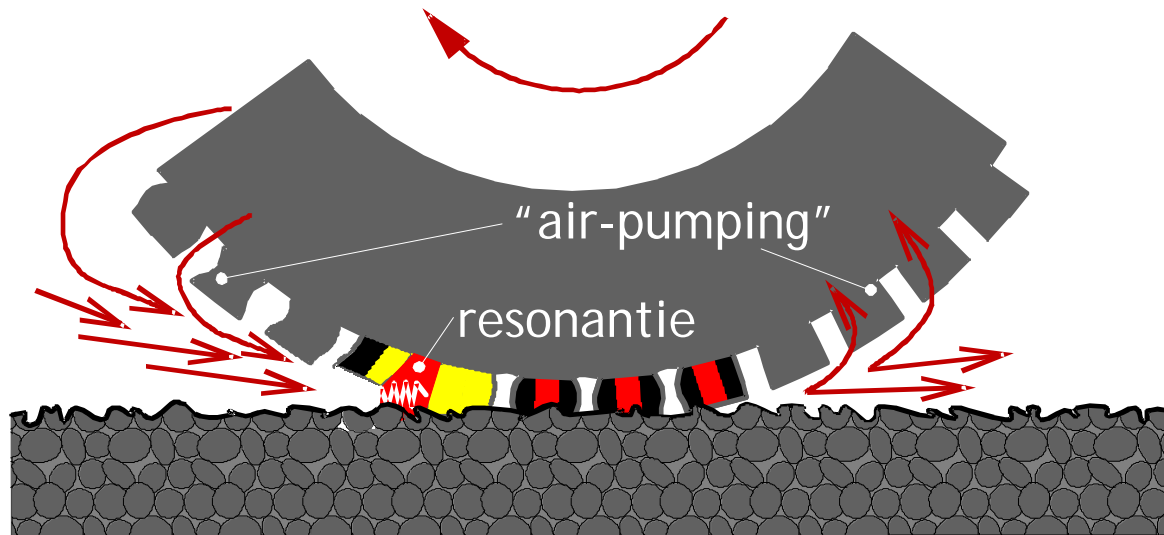


# Aerodynamische processen

band/wegdek interactie



- "air-pumping"
- Helmholtz resonantie
- kanaal resonantie



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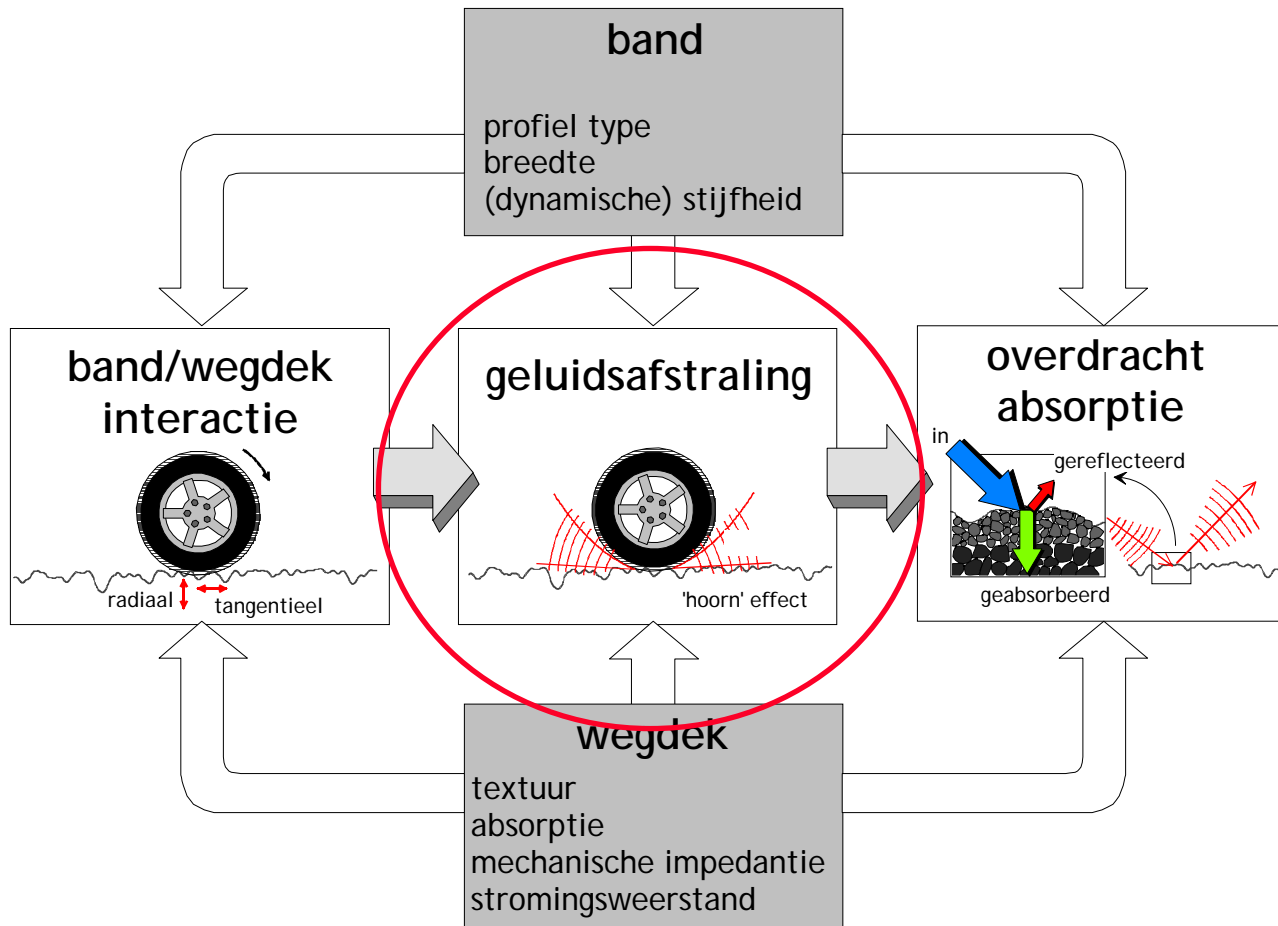
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# Opwekking band/wegdek geluid



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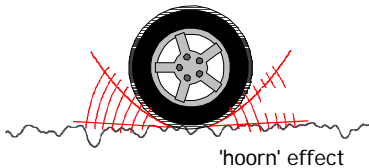
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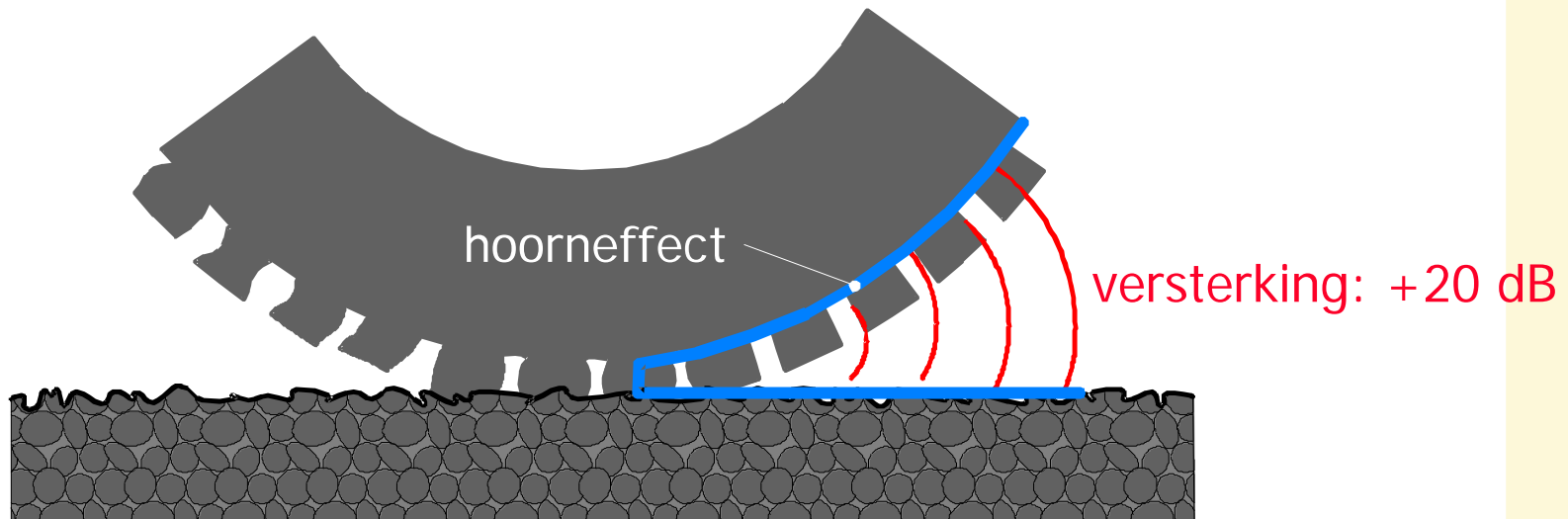


# Geluidsafstraling

geluidsafstraling



- Bandtrillingen veroorzaken afstraling geluid
- Afstraling wordt beïnvloed door:
  - Geometrie van band en voertuig
  - Akoestische impedantie ("absorptie") van het wegdek
- Hoorneffect



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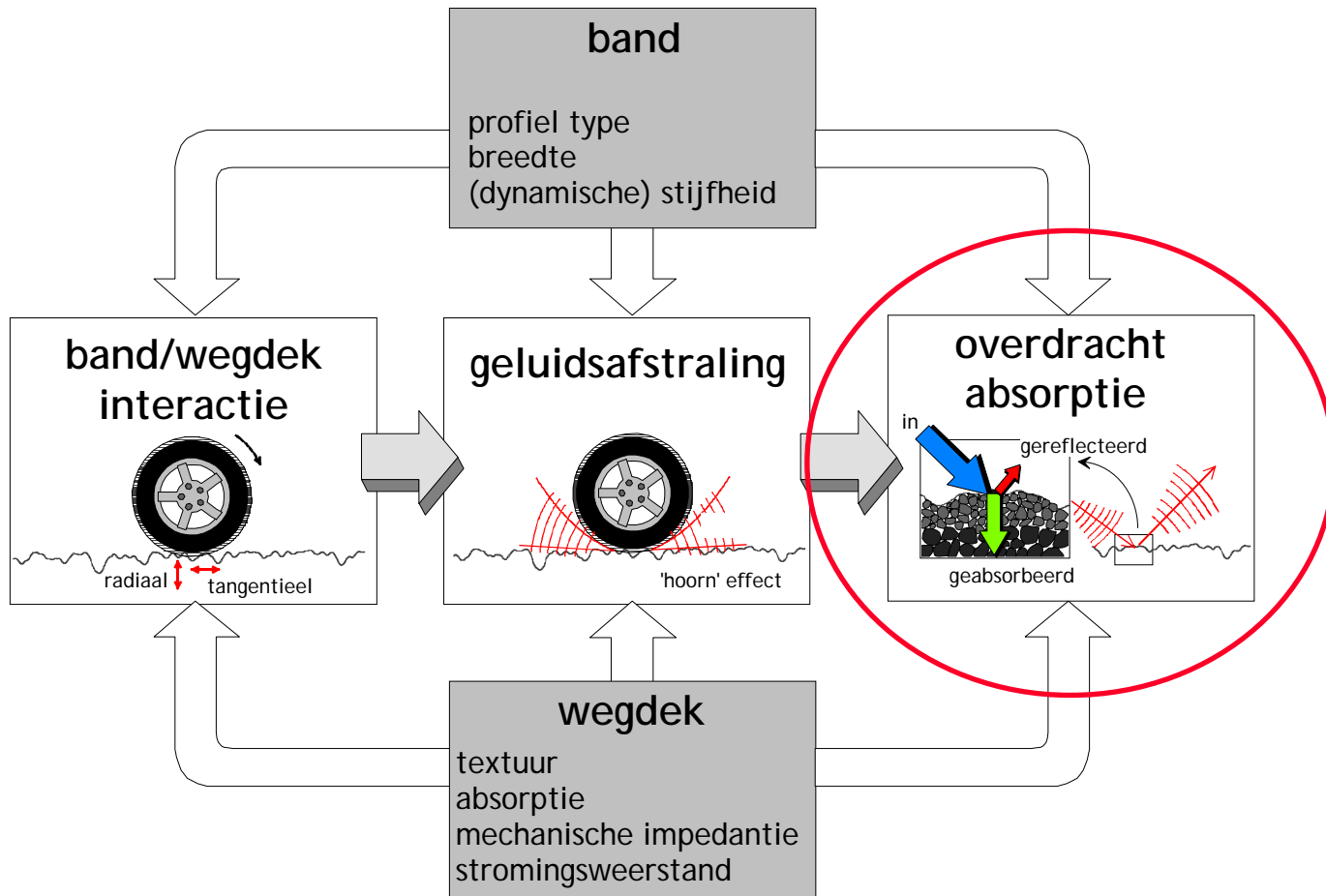
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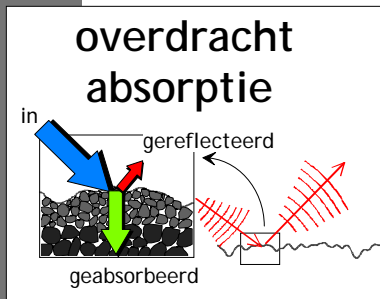
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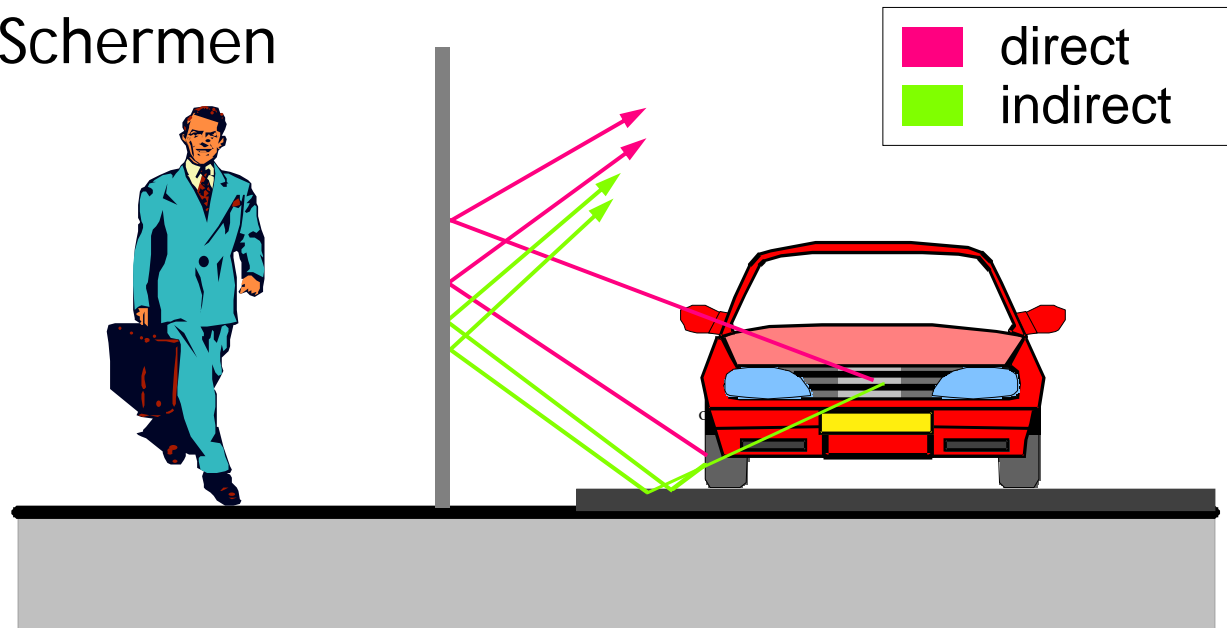
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# Overdracht & absorptie



- Absorptie van het wegdek
  - Laagdikte
  - Porositeit
  - Stromingsweerstand
- Schermen



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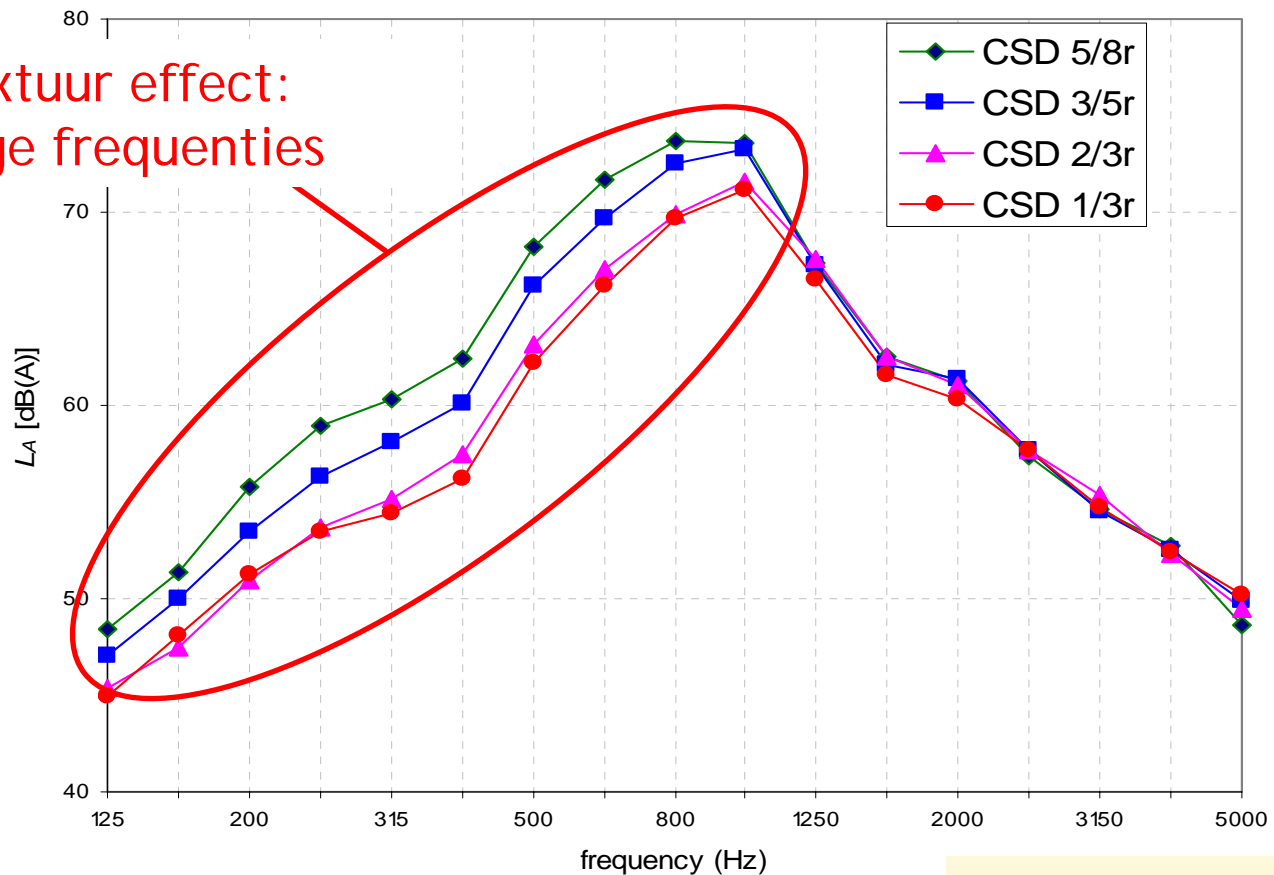
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# Invloedsfactoren: textuur

## Betonwegdekken met verschillende steengradering

textuur effect:  
lage frequenties



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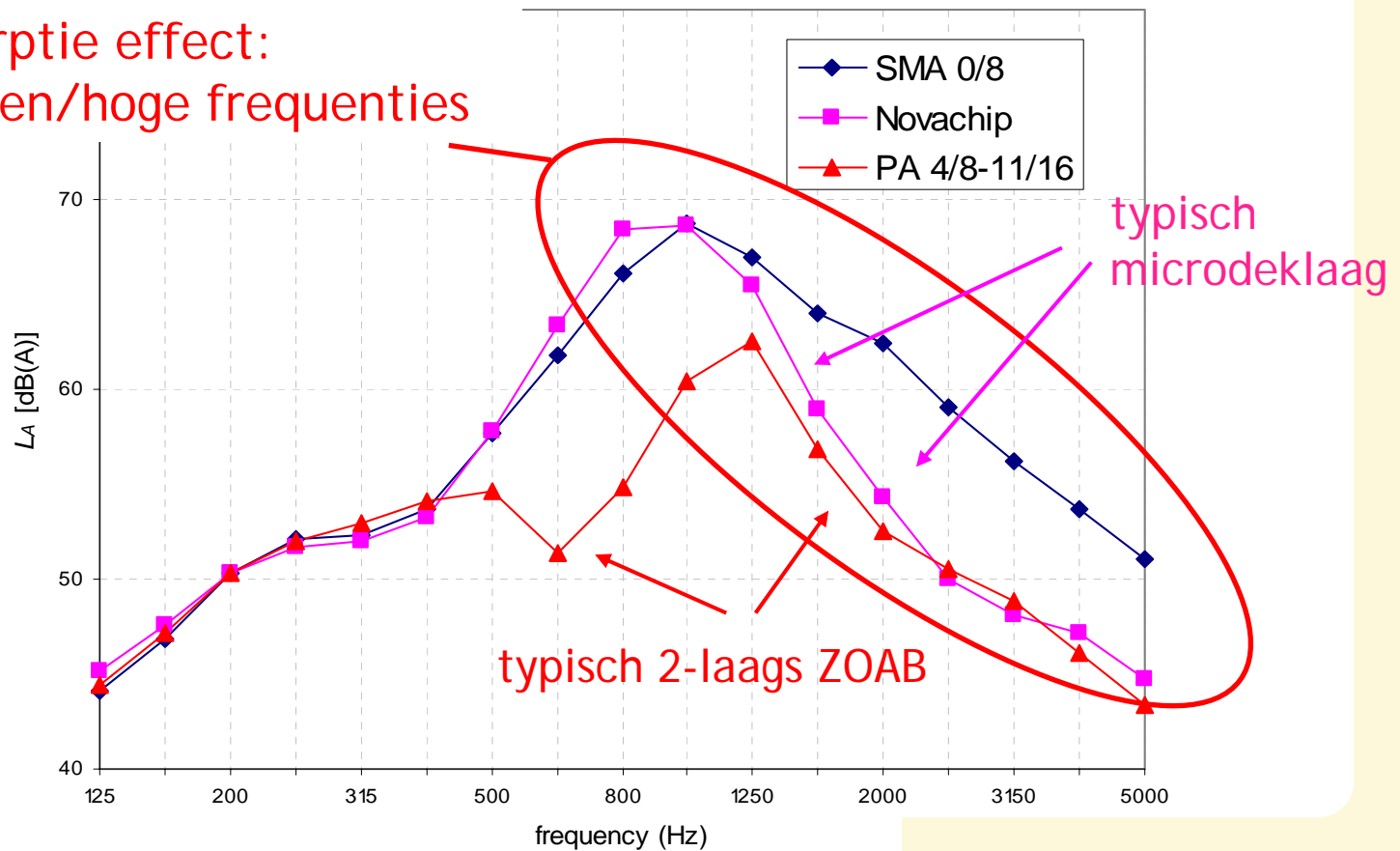
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# Invloedsfactoren: absorptie

## Asfaltwegdekken met porositeit/absorptie

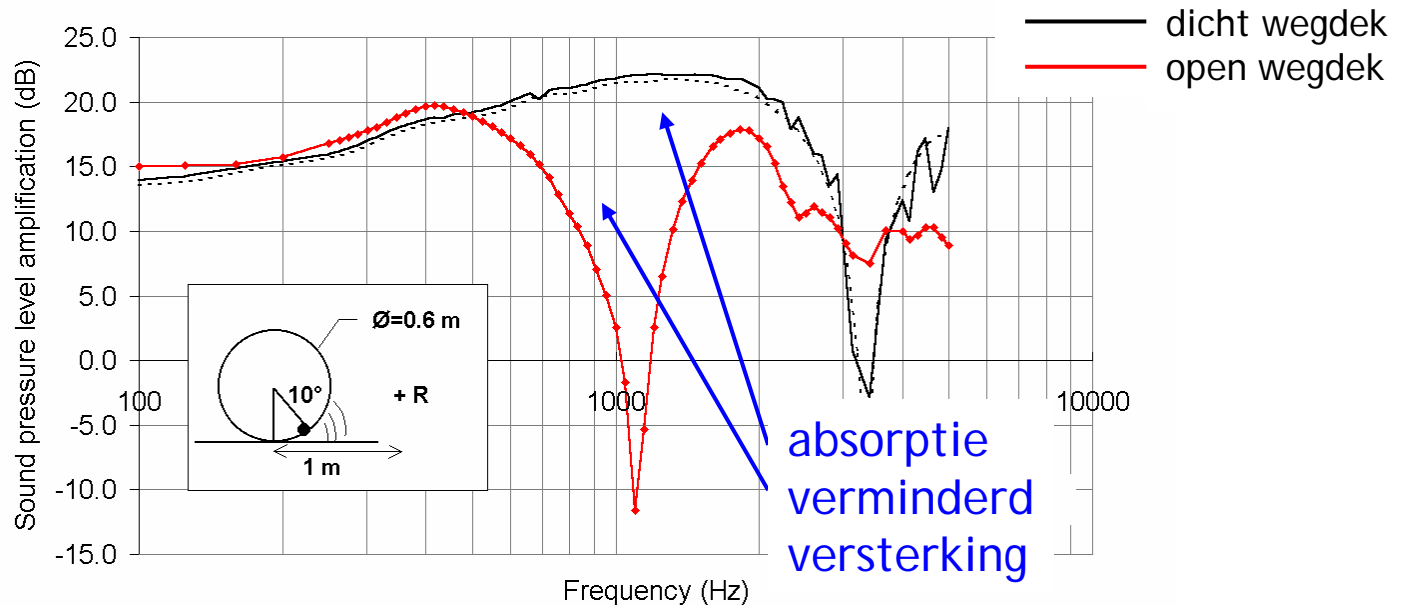
absorptie effect:  
midden/hoge frequenties





# Invloedsfactoren: absorptie & hoorneffect

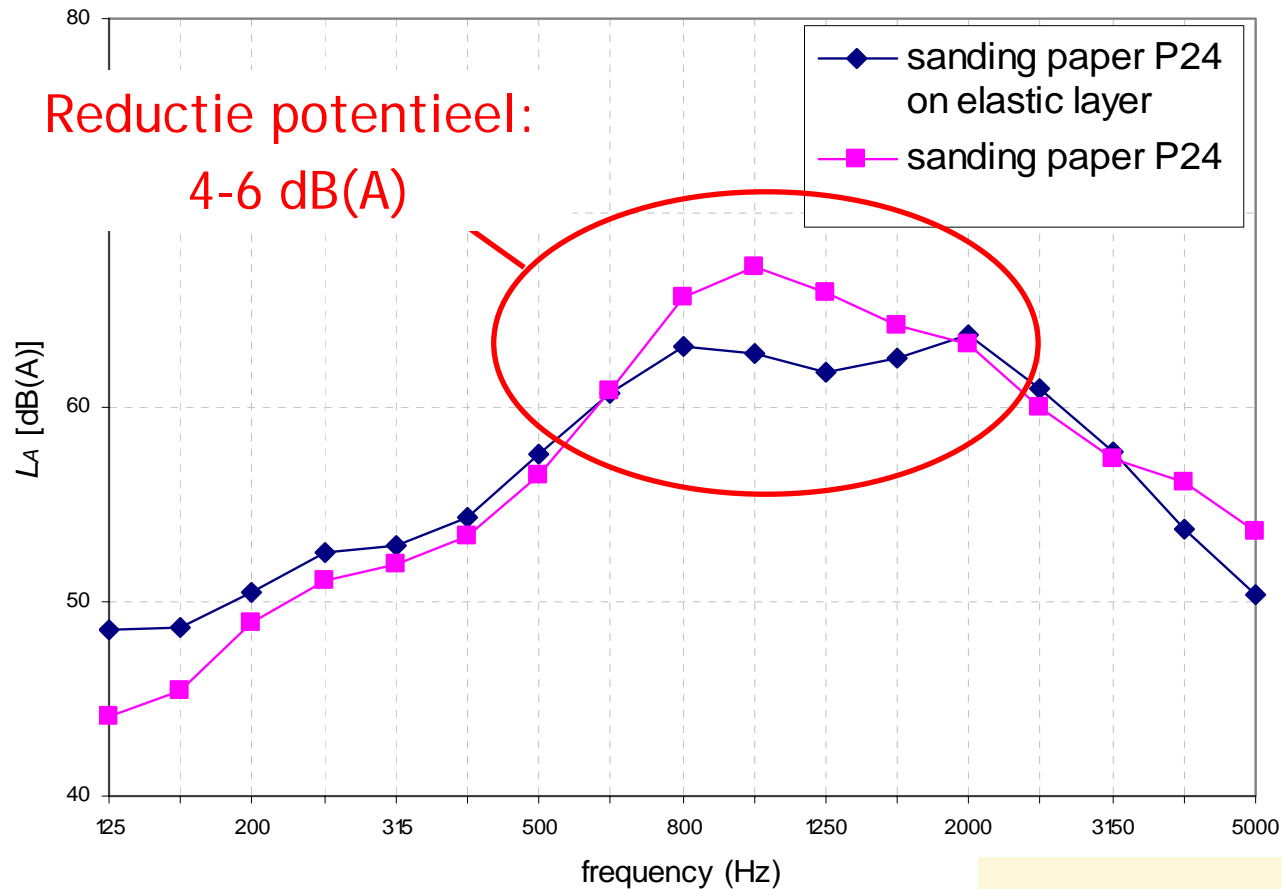
Absorptie wegdek zichtbaar in hoorneffect





# Invloedsfactoren: mechanische impedantie

Weg met fijne textuur, met/zonder elastische laag



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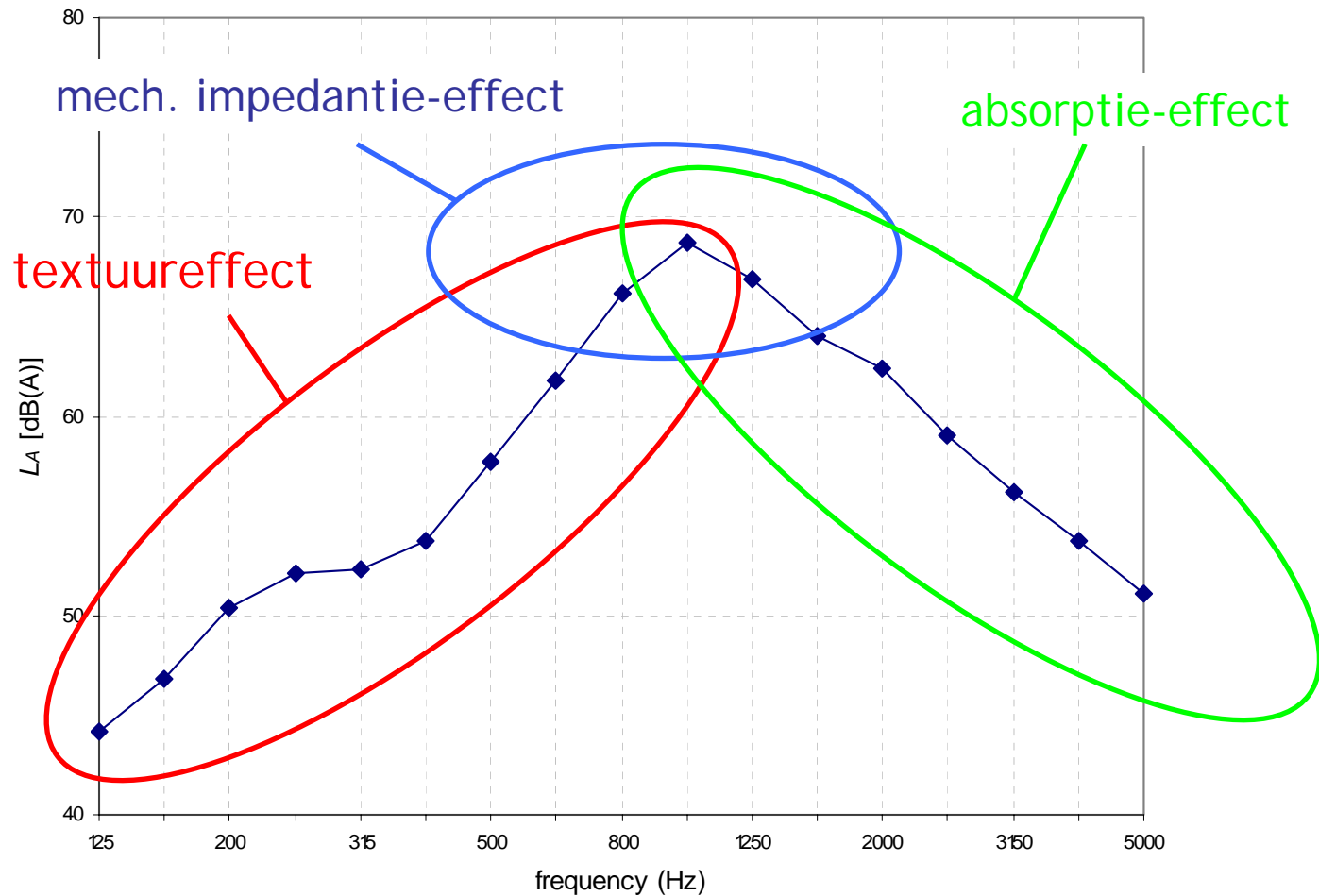
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# Invloedsfactoren: samenvatting



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# Modelvorming

## Doelstellingen van modelvorming

- Begrijpen van fysische processen
- Ontwerp van stille banden
- Ontwerp van stille wegdekken

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# Stand van zaken modelvorming

## Begrijpen van fysische processen

- We begrijpen de deelprocessen
- Modellen geven alleen kwalitatief antwoord

## Ontwerp van stille banden

➔ Presentatie Jan Leyssens

## Ontwerp van stille wegdekken

- Modellen voor textuurinvloed
- Modellen voor akoestische absorptie
- Modellen voor lokale trillingen in profiel ("air-pumping")

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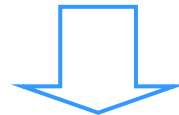
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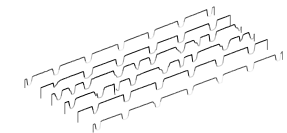
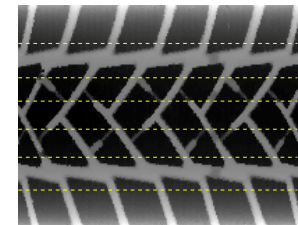


# Modelvorming: ontwerp van stille textuur

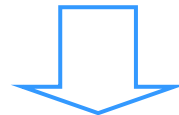
textuureffect: SPERoN model



Rekenprogramma SPERoN



bandprofiel



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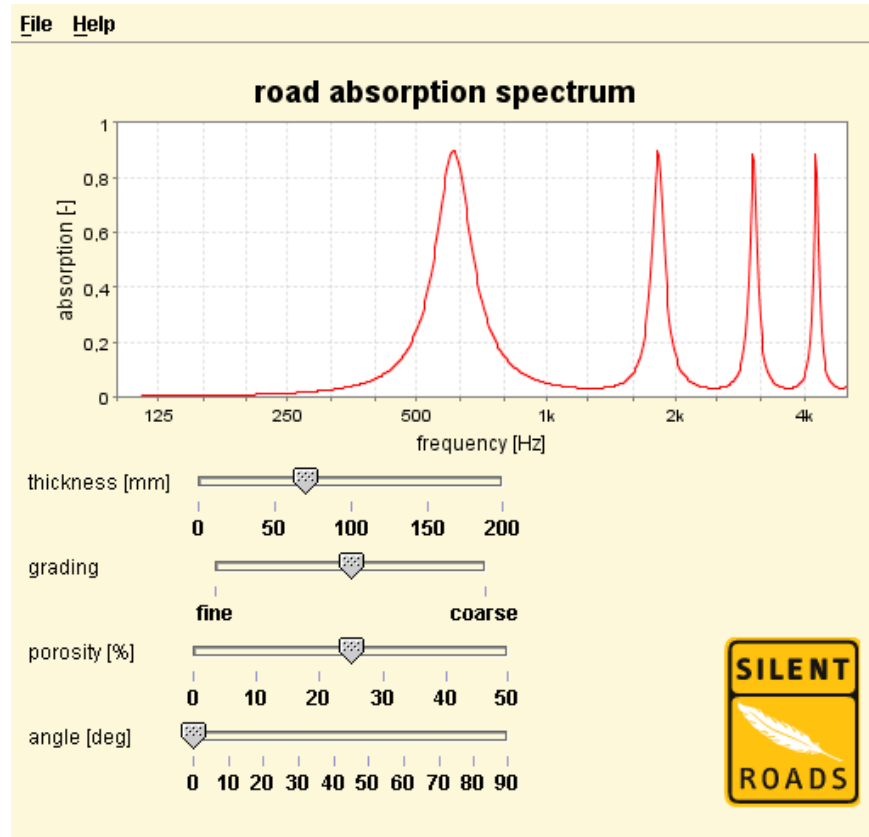
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# Modelvorming: ontwerp goede absorptie

absorptie-effect: demonstratie



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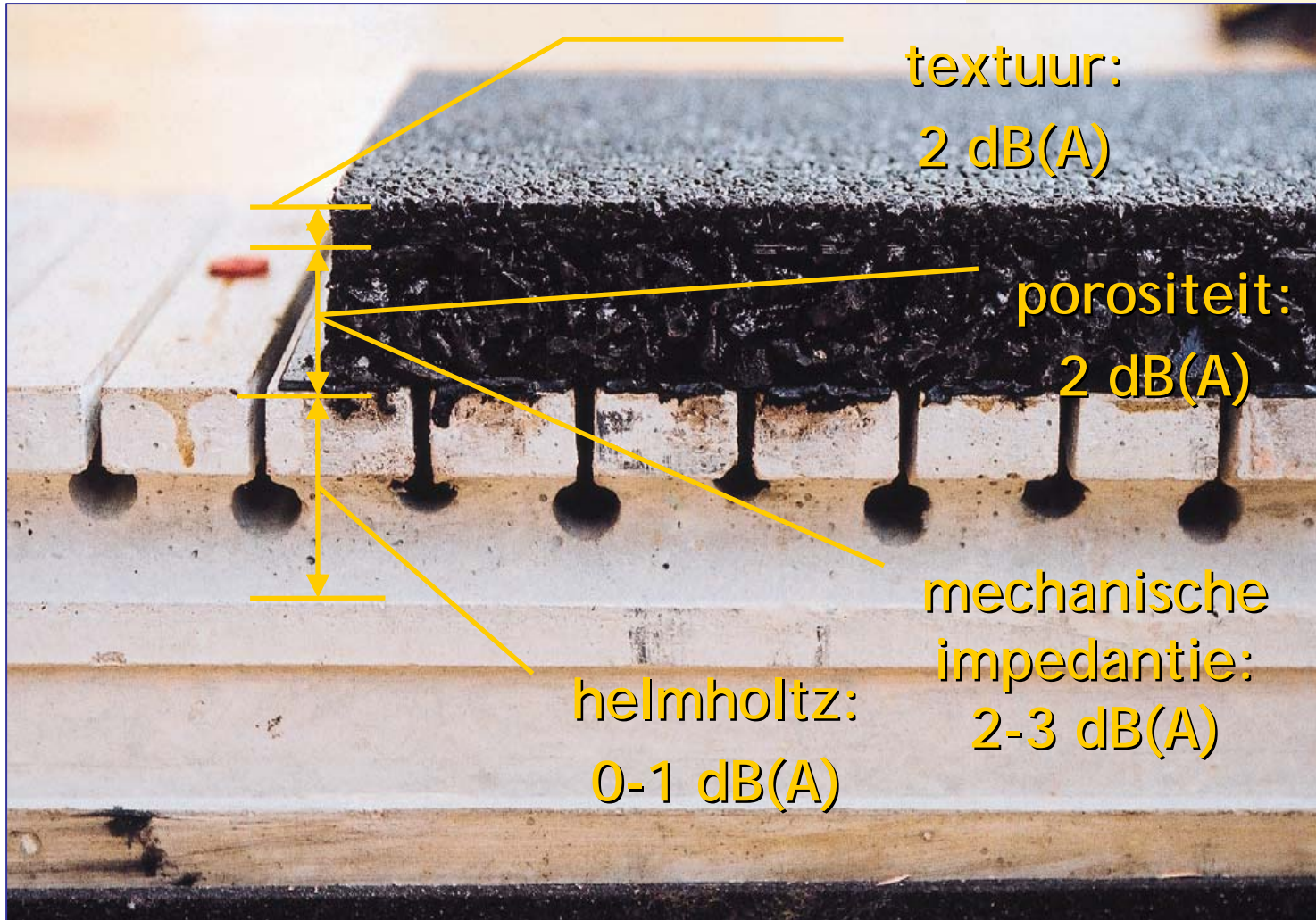
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# Modelvorming: ontwerp van stille wegdekken



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## Samenvatting

- Mechanismen: mechanisch en “aerodynamisch”
- Invloedsfactoren wegdekken: textuur, absorptie en mechanische impedantie
- Modellen: textuur- en absorptieinvloed
- Invloedsfactoren banden:  
→ Jan Leyssens (Goodyear Research)

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