Hrvatsko asfaltersko društvo

Croatian asphalt association

Ponašanje nisko bučnih kolnika:
pregled i najnoviji razvoj

Performance of low noise pavement:
an overview and latest development

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COLAS

EUROPE

Međunarodni seminar ASFALTNI KOLNICI 2019

International seminar ASPHALT PAVEMENTS 2019

Opatija, 04.–05. 04. 2019.

AGENDA

- European Environmental directive; human health
- Basic principles
- Requirements in some european countries
- Design of the recipes and evolution
- Last development

NOISE = POLLUTION

ENVIRONMENTAL NOISE DIRECTIVE 2002/49/EC

AFFECT ALSO NEW MOTORWAYS

By 2050, 75% of the population will live in megacities

WHAT IS NOISE AND LEVEL OF NOISE

- Acoustic pressure is the difference between atmospheric and sudden pressures
- Noise level is a function of acoustic pressure: L in dB = 10 log (P^2/Po^2)
- Reflecting soil increases noise propagation and absorbing soil decreases noise propagation
- Linear source (road traffic), when you double the distance, noise decreases by 3 dB(A)
- When you multiply by 2 the noise level, you increase the noise by 3 dB(A). By 10, noise increases of 10 dB(A)

ROLLING NOISE

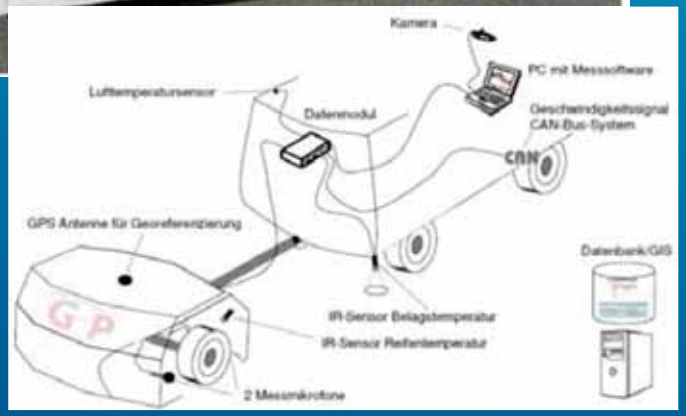
- Noise comes from engine, exhaust pipe, transmission,
- Aerodynamic noise
- Noise from tyre/road contact

This latter becomes dominant

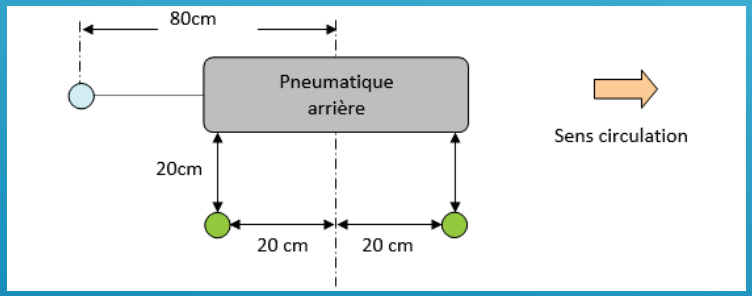
when the speed is over 50 km/h

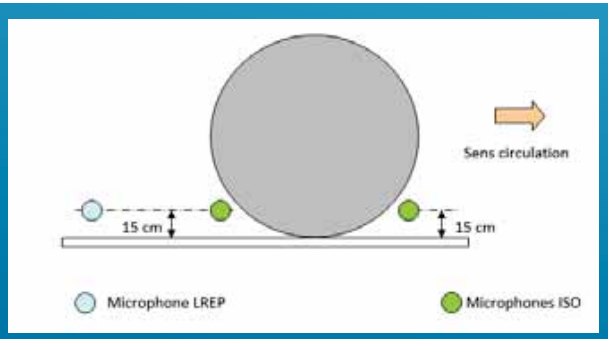
LOW NOISE ASPHALT

Method of mesurement



CPX (Close proximity
ISO 3rd CD 11819-2)





How to decrease the rolling noise?

- Porous asphalt was the first generation of low noise pavement (efficient absorption due to high porosity)
- Findings from the old porous asphalt sections:
  - Noise reduction around 3 dB(A) depending on the aggregate size compared to the DAC
  - Lifetime (7 years or more?)
  - Cleaning?
  - Use of small aggregate
  - What about winter maintenance?

NOISE-REDUCING ASPHALT MIXES

- Mix design
  - Size aggregates : decrease D
    - Asphalt mixes e.g. 0/8, 0/6 or 0/4
  - Void content
    - High void content to catch the noise

Examples of Requirements

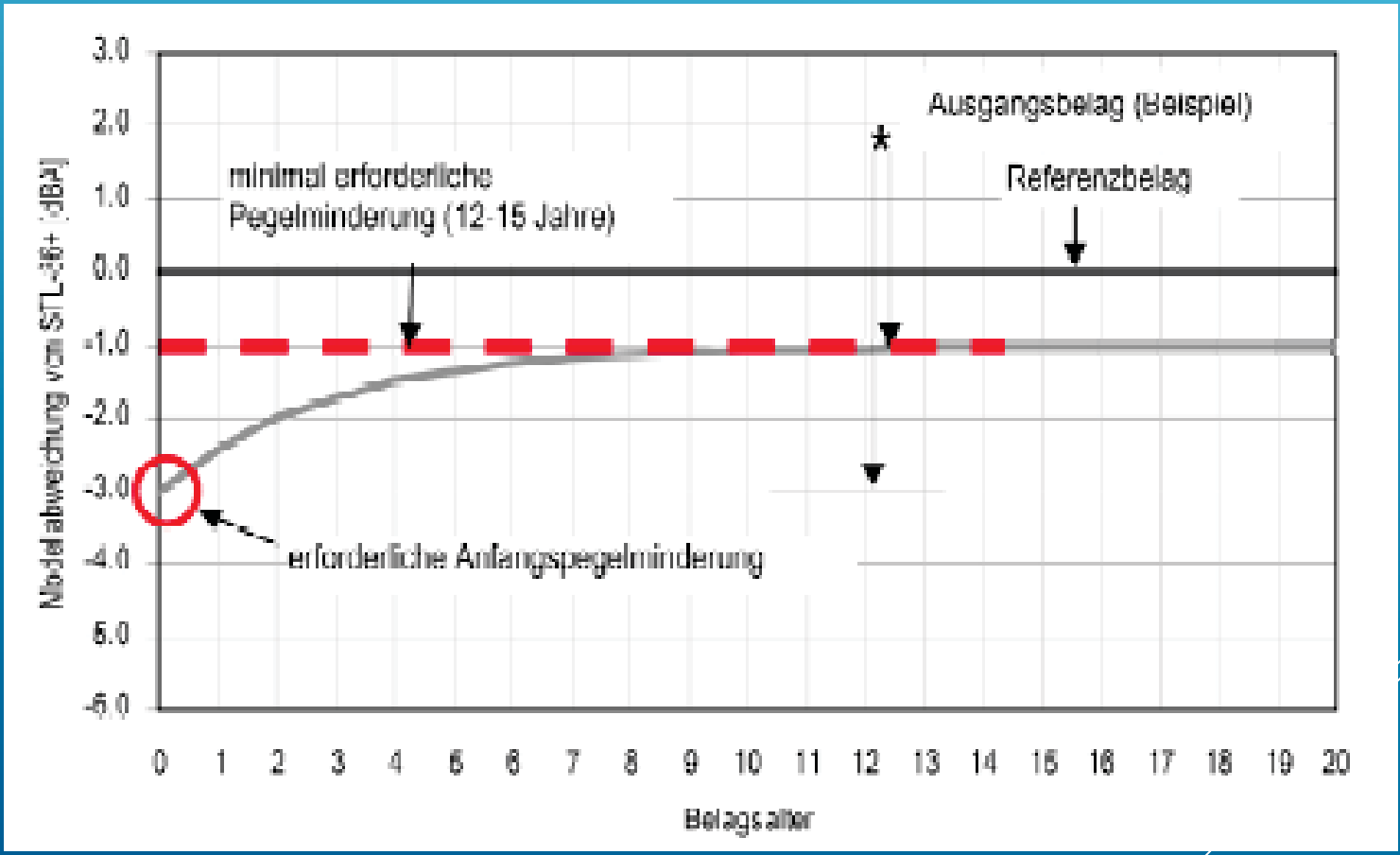
- **Decrease the noise by 3 dB** in some european countries for national network or city center
- For special products, some client required:

  -5 to -6 dB(A) just after the **laying**, **-4** dB(A) at **5 years** and **-1** dB(A) at **10 years**

LOW NOISE ASPHALT

For example in Switzerland:

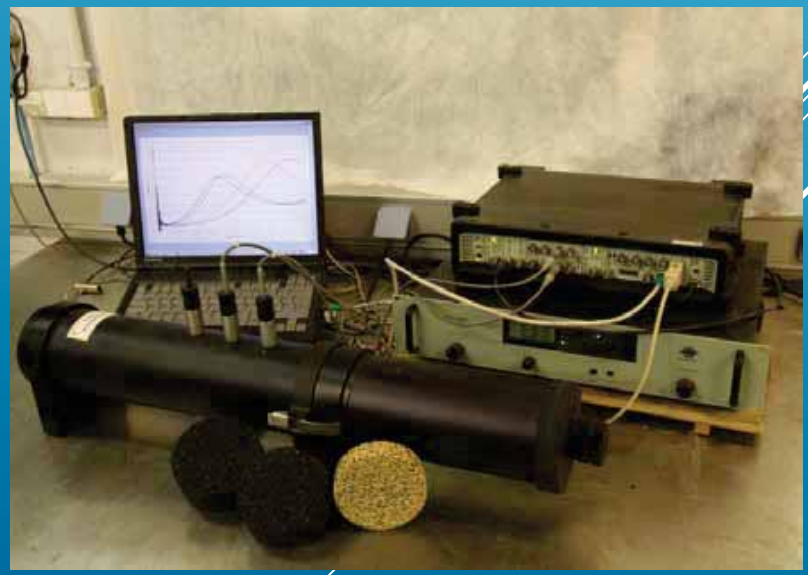
Definition of « Acoustic life duration»



MIX DESIGN TEST

- Void content
  - Rotary shear Press :
    - V200 ≈ worksite density

- Impedance Tube (Kundt tube)
  - Absorption coefficient dL(α)
    - V200 density
    - High from 25mm to 50 mm



FIRST GENERATION OF

Low noise wearing course

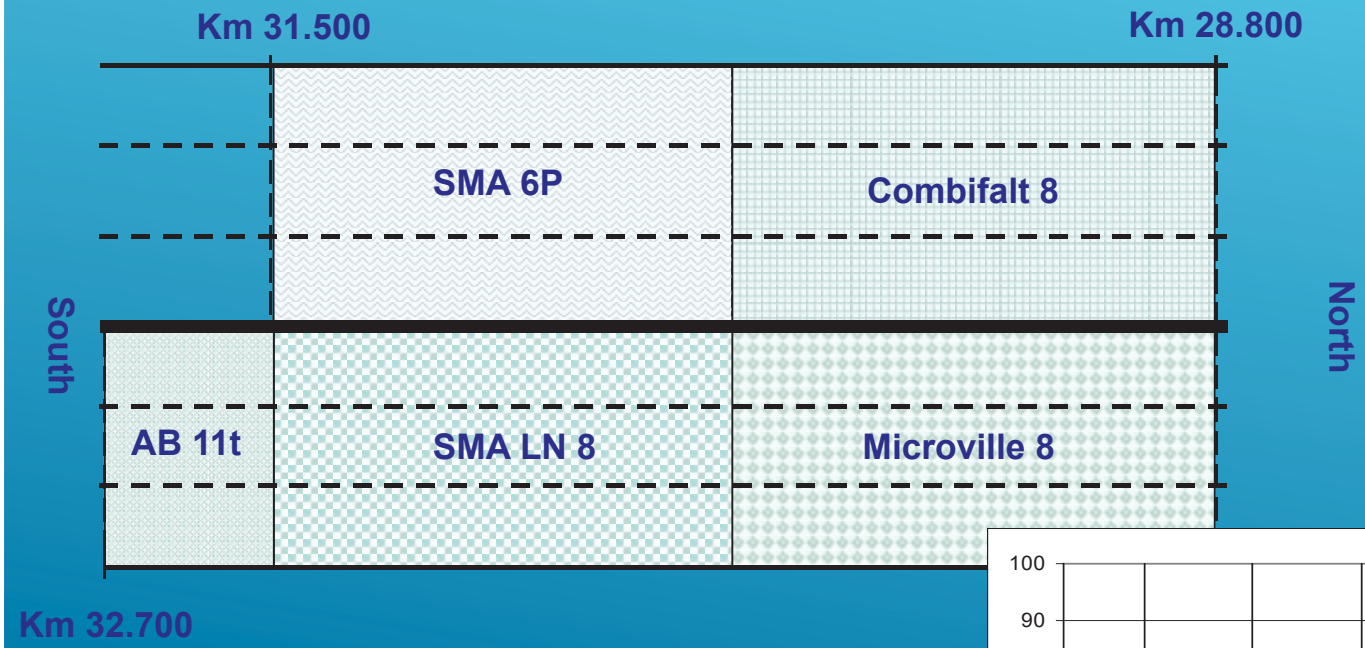
- Thin or very thin asphalt concrete (BBTM)
- Grading 0/6 with 2/4 discontinuity
- Modified binder or binder and fibers depending on the traffic
- Laying thickness from 2 to 3 cm (BBTM)
- Rolling noise decreases from 2 to 4 dB(A) at 90 km/h and 20 °C

FIRST PRODUCT : MICROVILLE

- Thin or Very thin asphalt concrete
- Maximum size grading : fine grading 4 to 8mm
- Discontinuous grading curve (0/2 +4/6)
- In situ Void content 16-22%

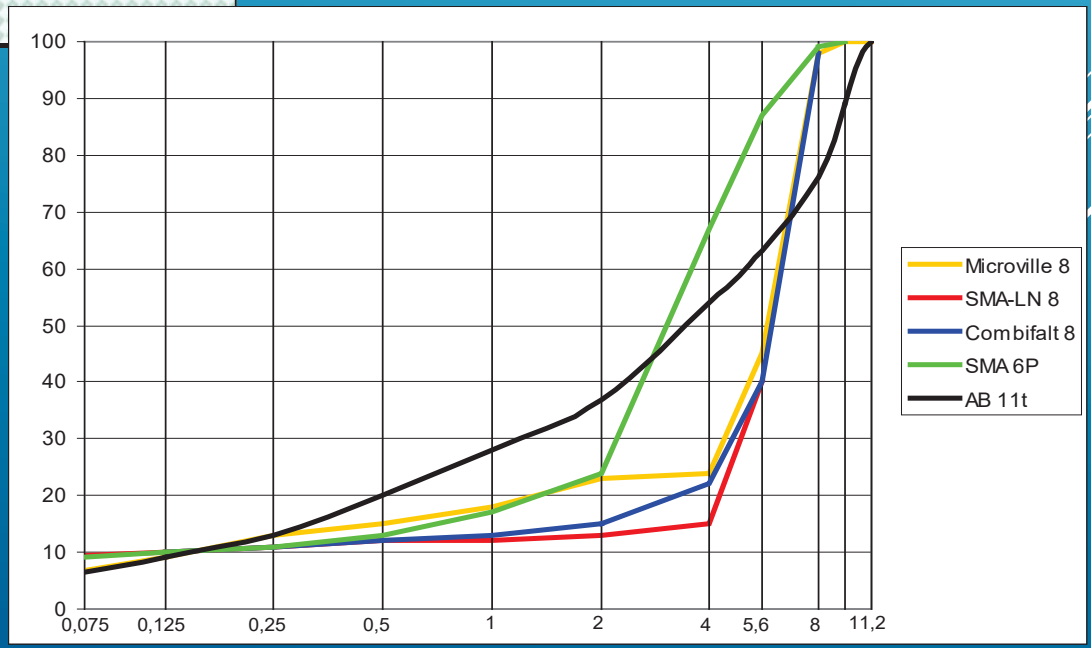
MICROVILLE DENMARK

- Denmark Highway M 10



5 asphalt mixes:

Microville designed with local available aggregates



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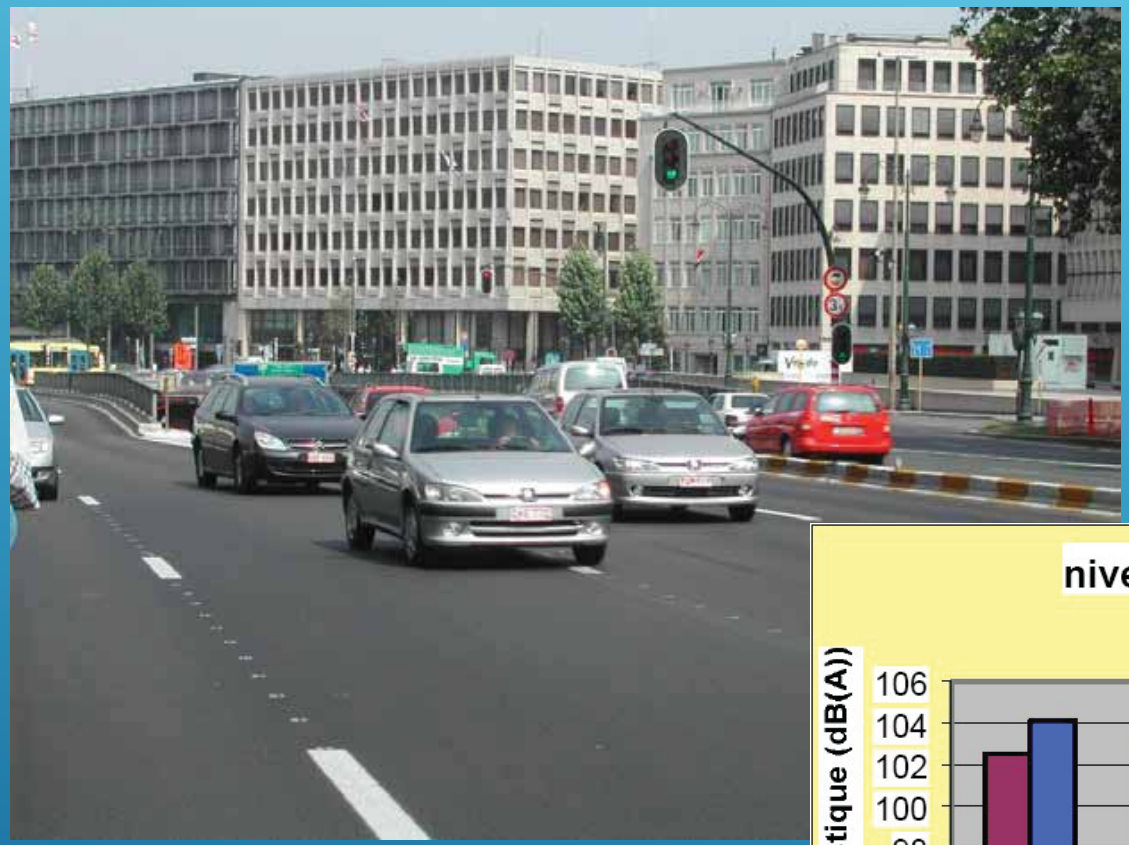
MICROVILLE DENMARK

Microville 300 000 m²

	AB 11t	SMA LN 8	Microville 8	Combifalt 8	SMA 6P
SPB I (After application	84	83.2	81.2	81.8	82.6
SPB I (1 year)	84.1	84.1	81.8	83.1	82.6
CPX I (09/04) [1]	99.4	99.4	99.2	99.9	98.6
CPX ISO (09/04) [2]	98.9	99.3	98.4	97.9	96.8
CPX I (10/05) [3]	99.1	98.6	97.6	98.9	98
CPX I (07/09) [4]	100.1	100.3	99.4	100.7	99.2

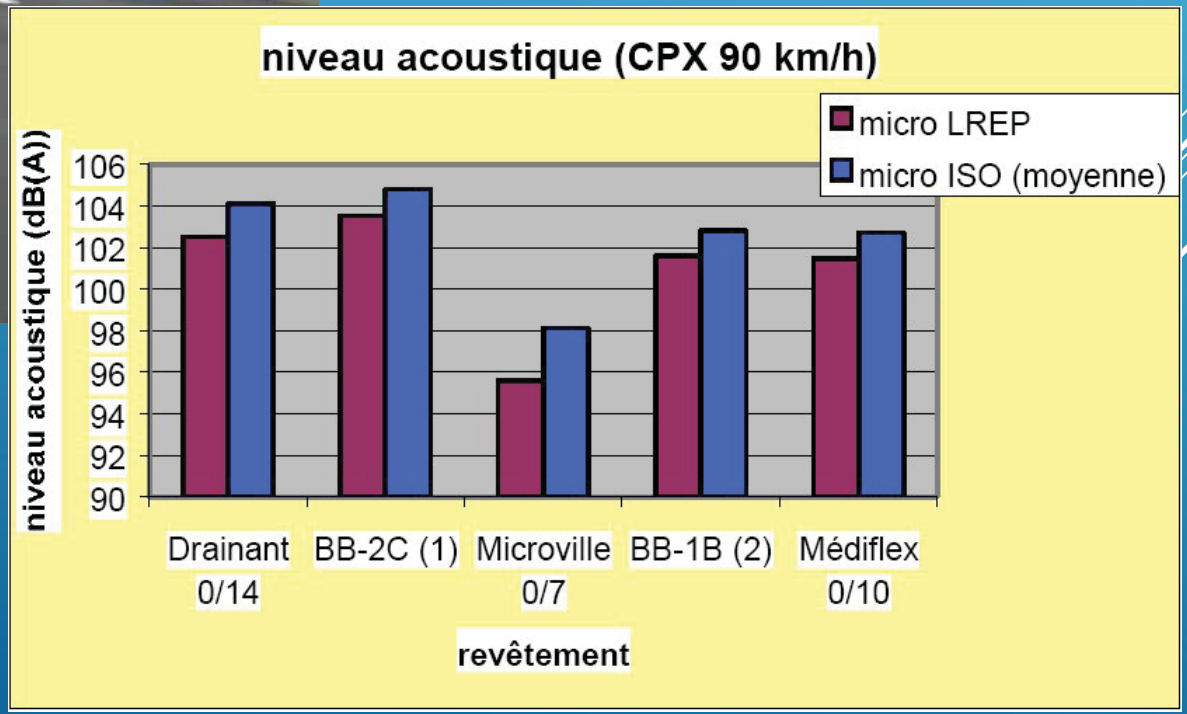
Stability and durability of noise reducing properties

MICROVILLE BELGIUM



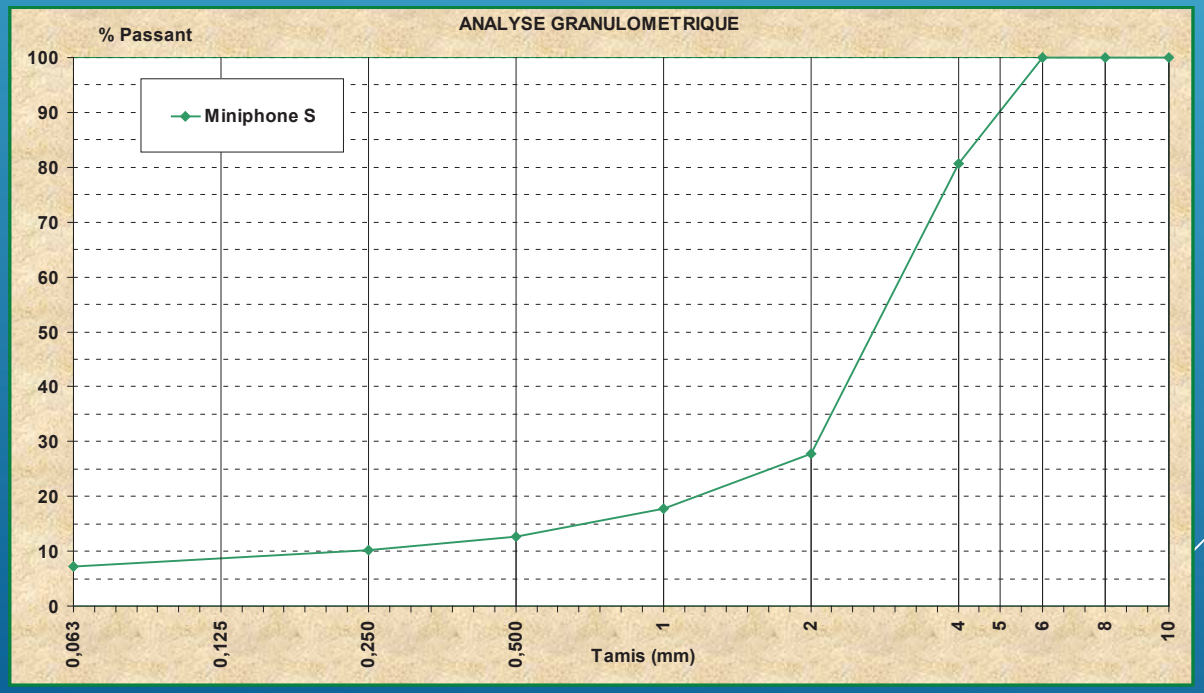
- Microville in Bruxelles
- 150 000 m²

CPX 50km/h ≈ 89 dB(A)



SECOND PRODUCT MINIPHONE S

- Thin or Very thin asphalt concrete
- Maximum size grading : fine grading 5 to 8mm
- Continuous or Discontinuous grading curve
  - (0/2 +0/5+2/4; 0/2+4/6+5/8)
- Specific noise reduction agregates
- In situ Void content 16-22%



Miniphone S

- Highway A480 Grenoble France

CPX 50km/h ≈ 86 dB(A)

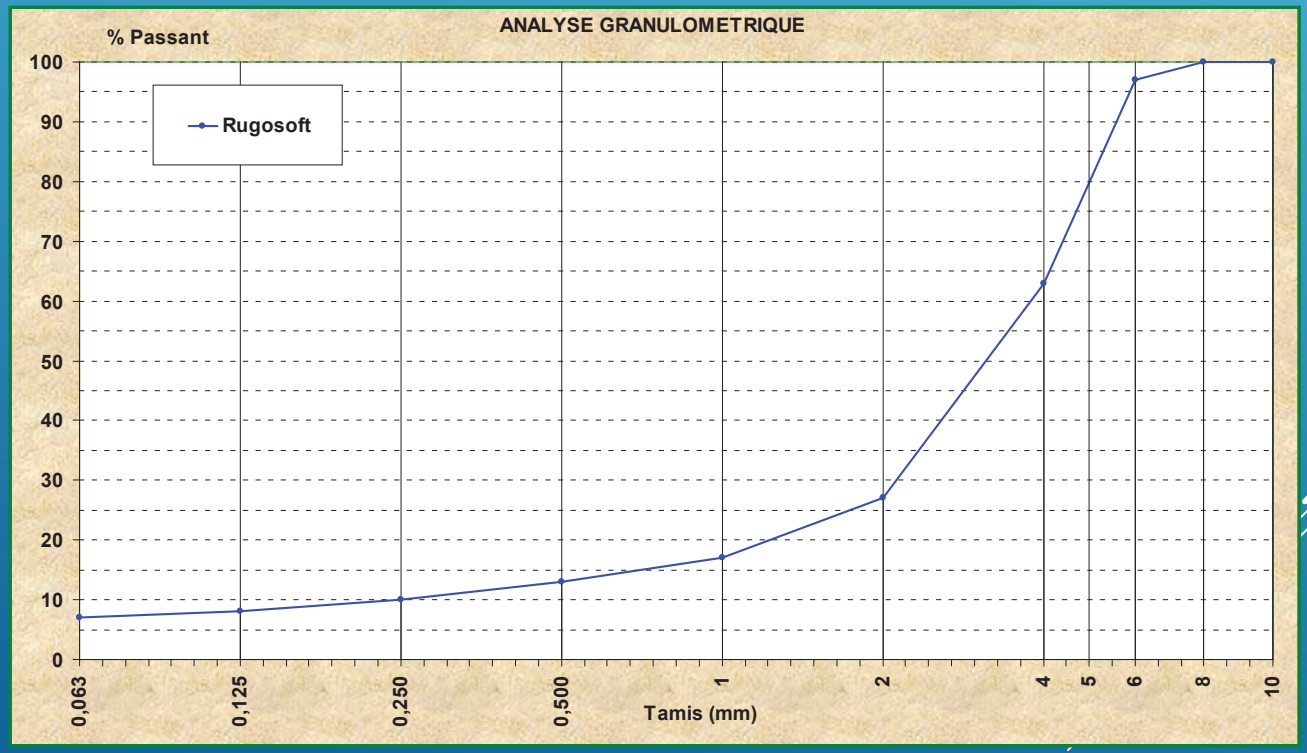
SECOND GENERATION

- Thin or very thin asphalt concrete optimization to improve
  - Increasing skid resistance
  - Lowering rolling noise

as much as possible

RUGOSOFT

- Thin or Very thin asphalt concrete
- Maximum size grading : fine grading 6 to 8mm
- Continuous grading curve (0/2 +2/4+4/6)
- In situ Void content 15-20%



RUGOSOFT

Glogowska Street, Poznan (Autoroute no. 5)

- 100 000 m² in Poznan, Poland

Niepodległości Avenue, Poznan

CPX 50km/h ≈ 88dB(A)

RUGOSOFT

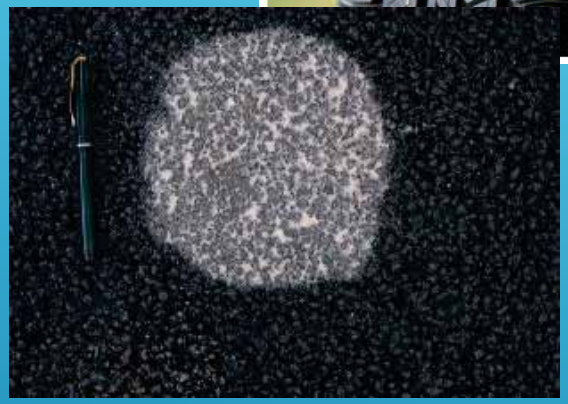
- 20 000 m²

Denmark experimentation

4 lane roadway Holbaek

NANOSOFT ®

Caractéristique	Unité	Nominal value
PSV agregates	[-]	> 50
Voids (Marshall – vol)	[%]	> 22
Connecting voids(*)	[%]	0.1 – 2.0
Macrotexture (Sand fleck)	[mm]	0.67 / 0.70
Drainability (**)	[l/min]	1.8 / 1.9

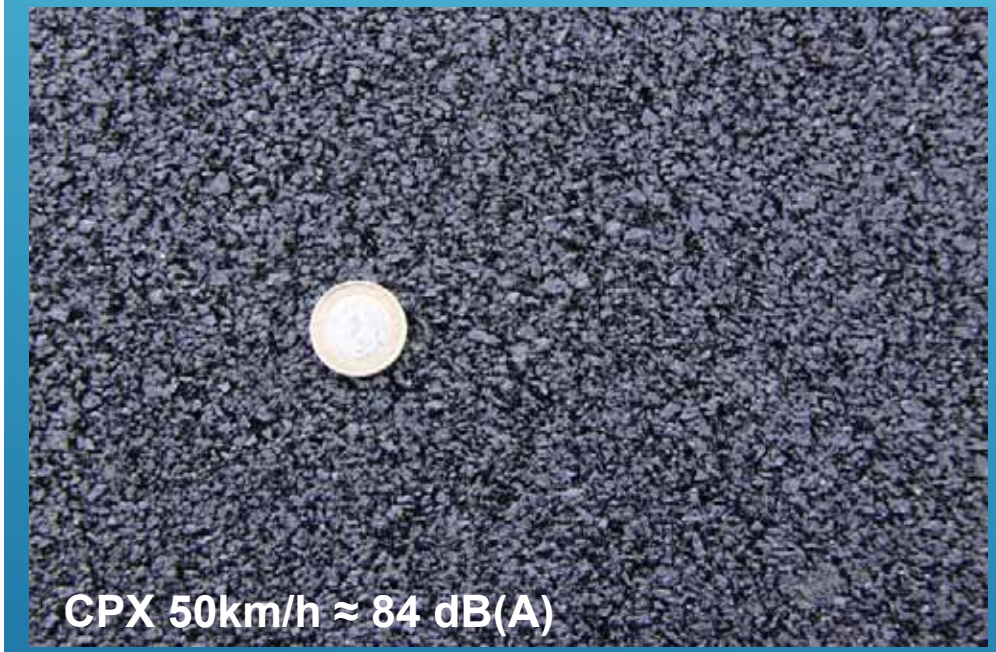


(*) : AC MR 8 : connecting voids = ~ 1%.

(**) : selon SN 640 430b, min. standard drainability for PA 8 (unique value) is > 10 [l/min]

NANOSOFT

- Nanosoft in Kornik Poland
- 58 000 m²



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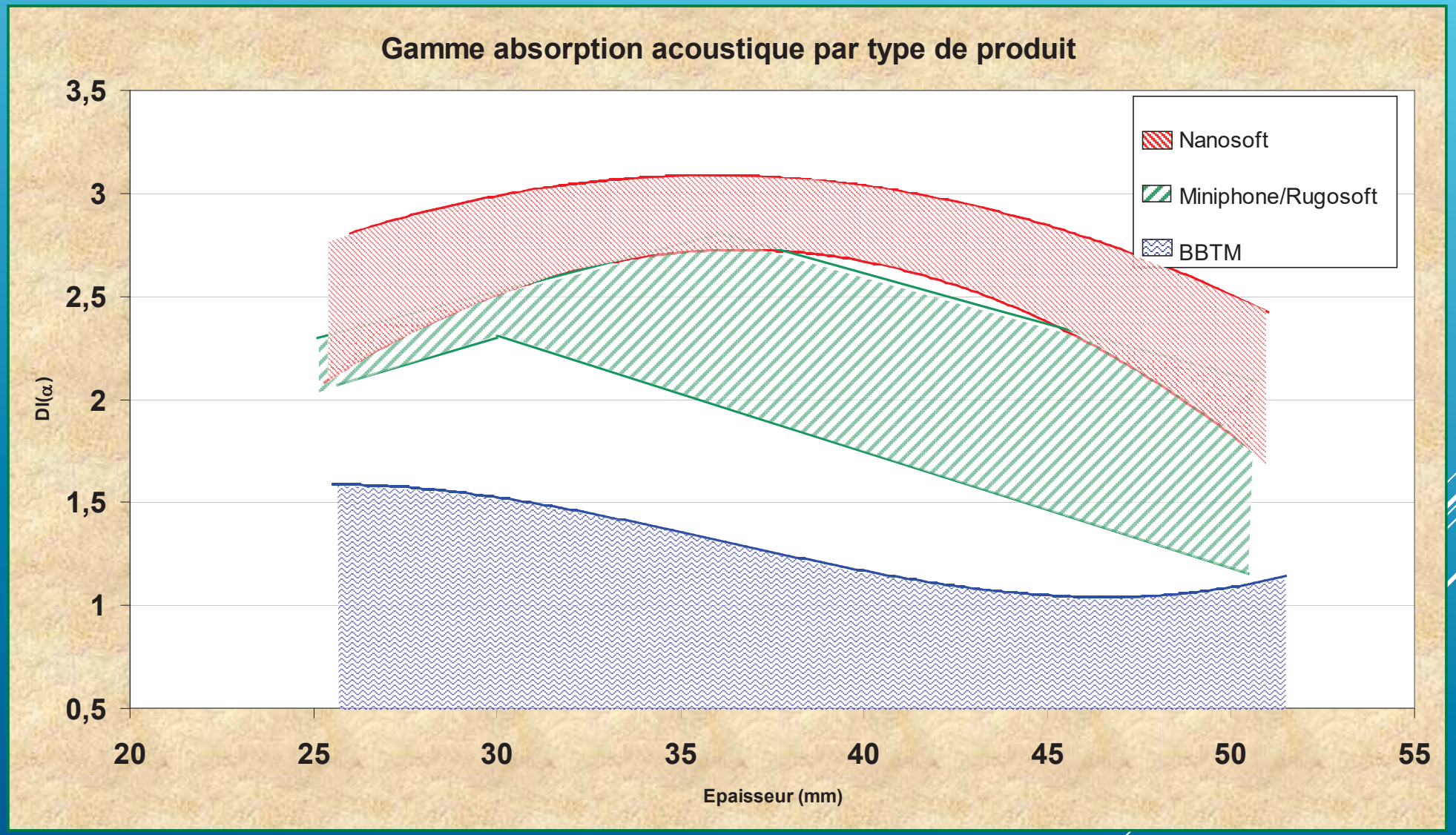
ABSORPTION DATABASE



NEW RESEARCH AND THIRD GENERATION

Lower the rolling noise below 70 dB (A)

NANOSOFT® V2

- Grading 0/2 2/4 or 1/4
- Voids (production): 20-21 %-vol
- Voids in site: 17-21 %-vol
- Binder: E85 or E125
- Special additive: 1-2%

RESULTS FROM THE THIRD GENERATION

- Close proximity methods
  - 90 km/h **≤ 91 dB(A)**
  - 50 km/h **≤ 82 dB(A)**

    either around **1 to 3 dB(A)** less than second generation
- Statistical Pass by method (Individual personal car)
  - Result ≤ 70 dB(A),
  - Gain of 3 dB(A) versus BBTM 0/6
  - Gain of 9 dB(A) versus traditional wearing course

- Statistical Pass by method (cars according to ISO 11819-1)
  - Less than 2,5 dB(A) versus second generation

NANOSOFT®

Silting up / cleaning of the wearing course test

- Machine CBC
- Protocole idem Weibel
  - 160 bars, ~7 mètres/min

CONCLUSION

- Increasing demand from the authorities, directive and the societal acceptance of the road

- More comfortable and silent road products for noise reduction exist since more than 20 years

- Two products are still in the COLAS's catalog today:
  Rugosoft : easy to produce, good compromise between skidding, noise absorption and cost
  Nanosoft: the best in term of noise reduction but costly and

There is still some development of low noise asphalt **for high traffic and very cold climate**

THANK YOU FOR YOUR ATTENTION