



Rijkswaterstaat
*Ministry of Infrastructure and the
Environment*



Porous Asphalt

Dutch experiences with Porous
Asphalt pavements

Inge van Vilsteren



Rijkswaterstaat

Networks

Roads



Water management



Water



↳ 90 km², more than 85% Porous Asphalt



Effect of porous asphalt during rain





Noise reduction

In Netherlands Porous Asphalt (PA) used to:

Reduce Noise

(Dutch PA starting point = Single-layer PA16 is 4 dB(A)
Two-layer PA8 is 6 dB(A) relative to dense Asphalt Concrete)

Positive side effects

- No splash and spray (less traffic jams during rainfall)
- Negligible pollution of verge
- Comfort during rain
- No rutting



Standard Single-Layer Porous Asphalt

Mix composition of PA 16

Aggregate

On sieve	desired	max.	min.
16.0 mm		0.0	7.0
11.2 mm		15.0	30.0
8.0 mm		50.0	65.0
5.6 mm		70.0	85.0
2.0 mm		85.0	
0.063 mm	95.5		

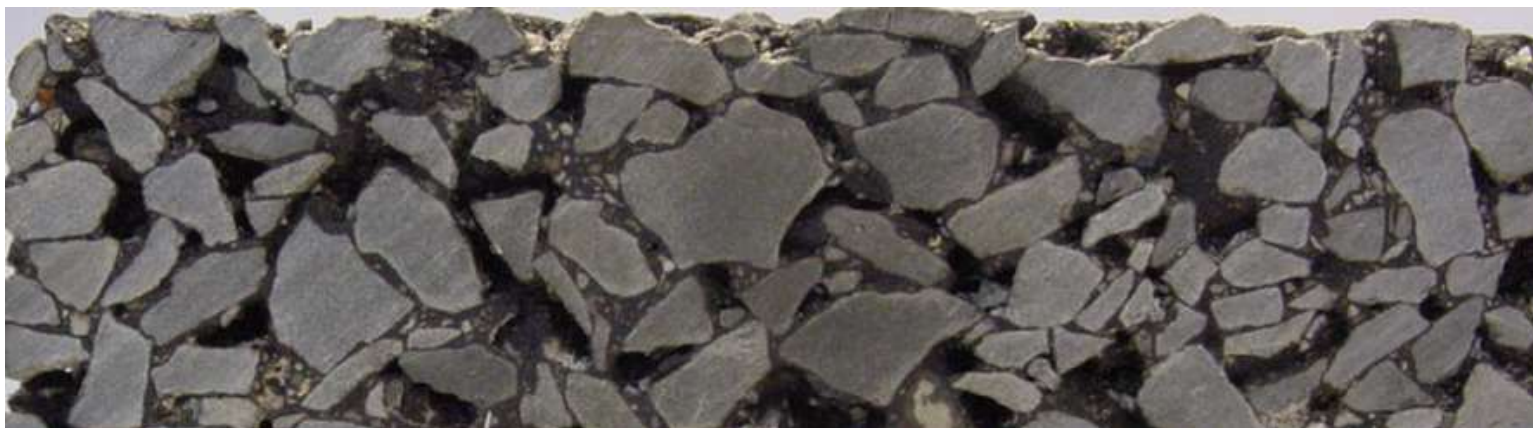
Bitumen 70/100 **5.2 % NO PMB USED**

Remarks:

PA+ also contains a drainage inhibitor (fibers),
and a filler having 25% hydrated lime (Ca(OH)_2) → improves durability



Porous Asphalt (PA) layer



∨ 50 mm ∨

20 % Air void. Stone skeleton 0/16 mixture



Two-layer Porous Asphalt



Standard construction

- 25 mm top layer 4/8
- 45 mm bottom layer 11/16

Application only if it is cost-effective noise reduction (i.e. saves costs of noise barriers)



Maintenance techniques for PA

PA (50 mm) replacement after 17 years on all lanes





Maintenance techniques for PA

Inlay PA (25 mm) after 11 years on slow lane



Raveling at the end of an inlay



Spay emulsion bitumen with rejuvenators



New PA mixtures (innovation)

Half-warm foamed PA16

Test sites laid in 2010, 2013, 2014 and more recent on RW31(2016) and A59 next weekend (2017)

- Production temperature 100 degree C
- 40% less energy is needed
- Saving of 25% CO2 during production
- Until now performance the same as hot PA

PA16 and TLPA with acrylic fibres

Several PA and TLPA test sites laid from 2003 to 2017

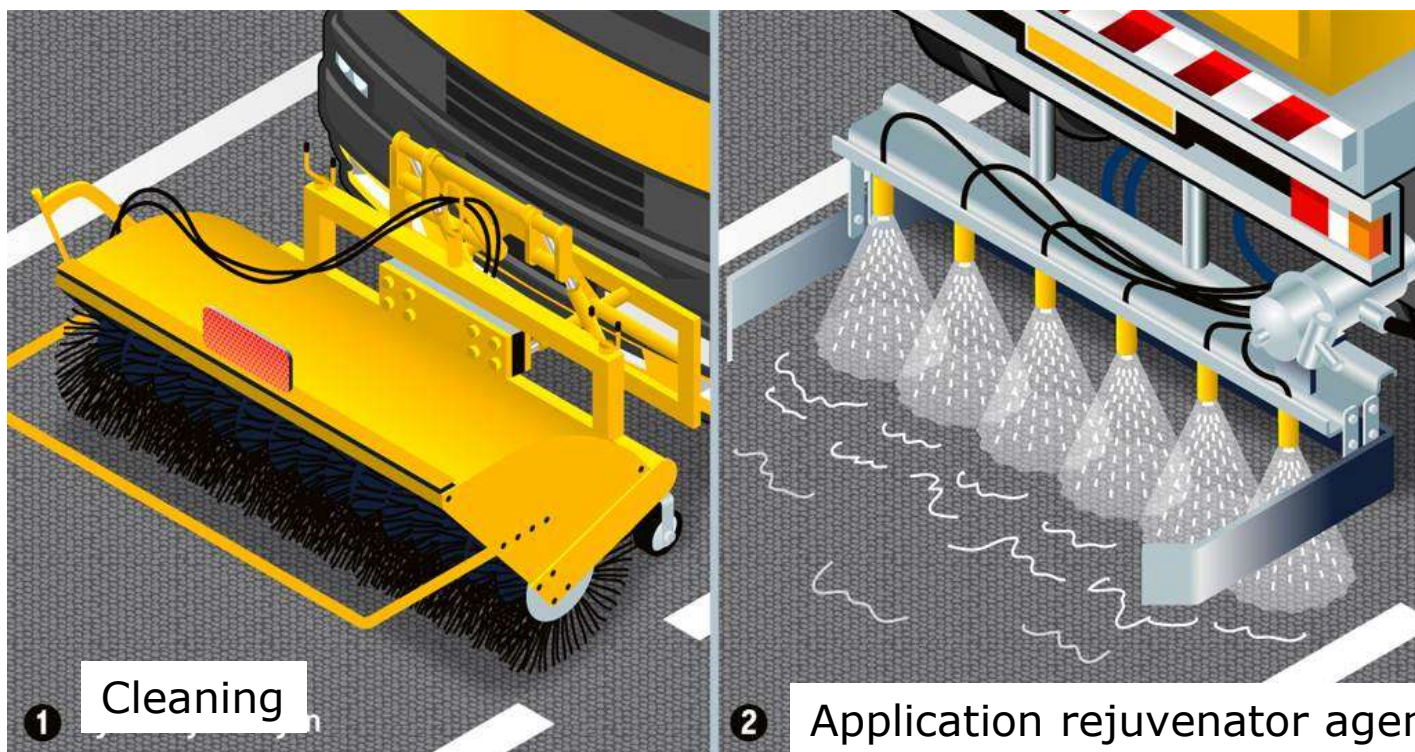
- Longer service life of PA is expected
- It is possible to lay TLPA with bitumen 70/100 without PMB's
- Acrylic fibres reduces ageing and improves the resistance to erosion of the mortar bonding bridges.



Novel Maintenance techniques for

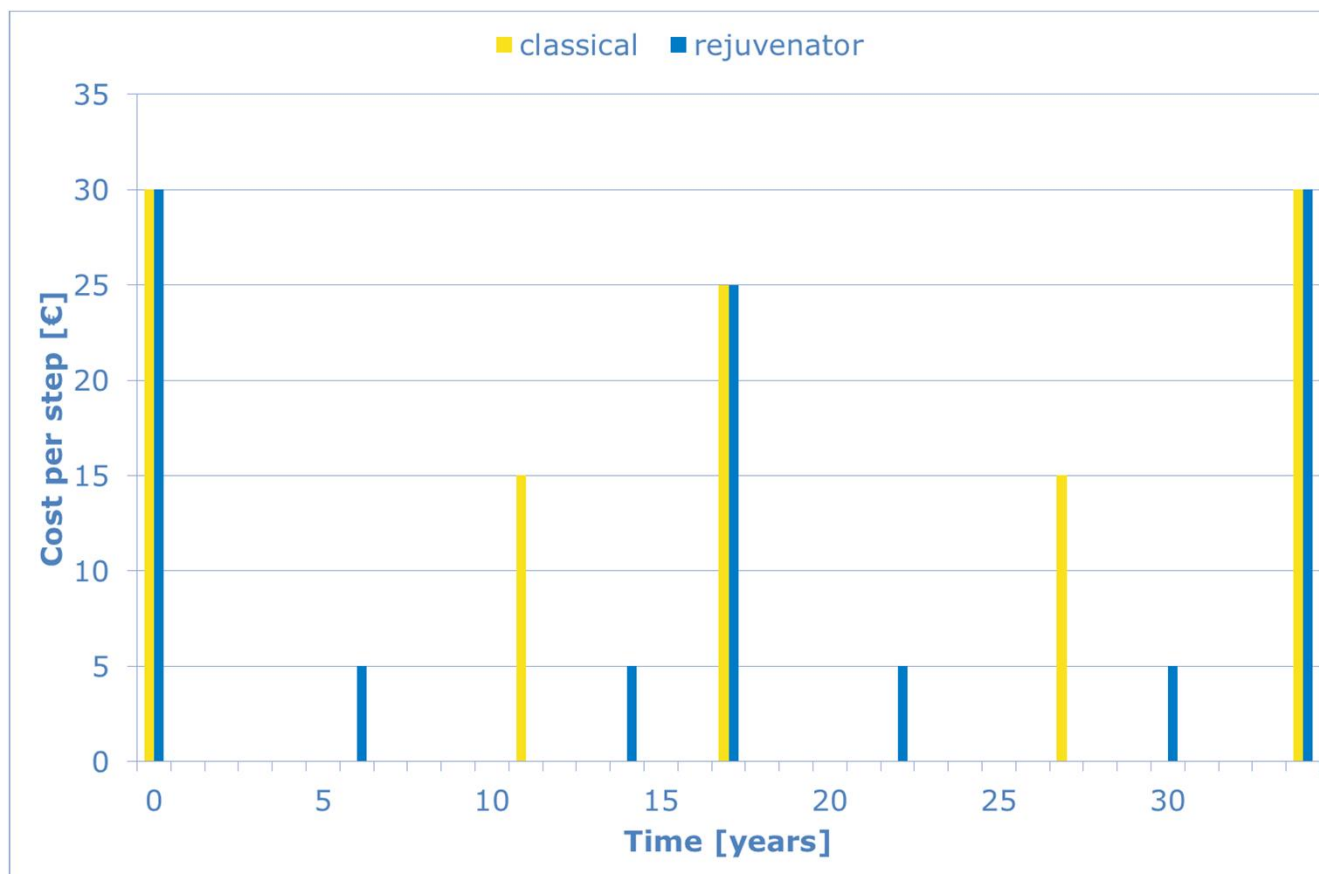
PA

Rejuvenation after 7 years on most trafficked lanes



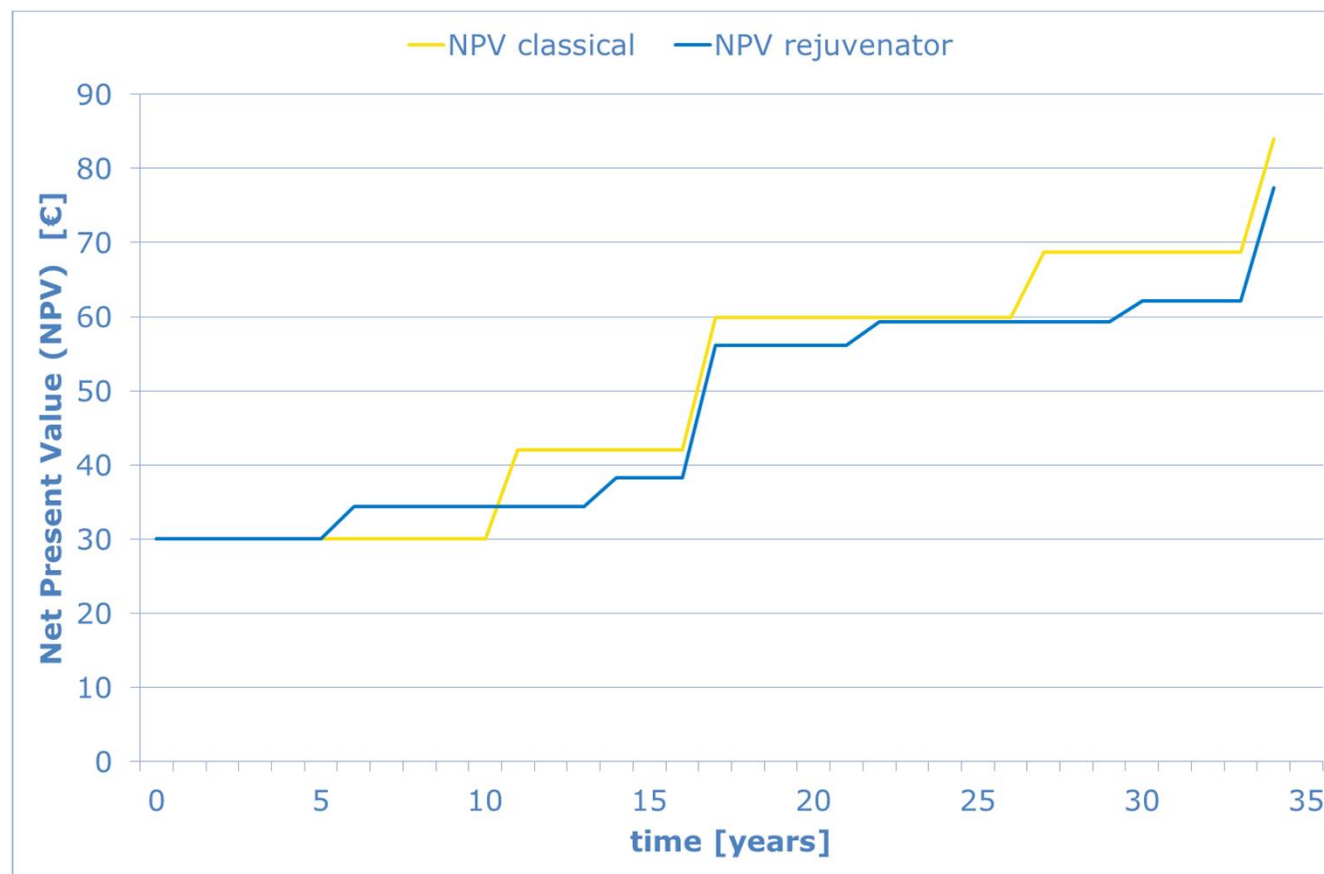


Costs (indication) per action





LCC comparison (fictive numbers)





Dutch experiences with Porous Asphalt pavements

- PA is our standard wearing course (reason: noise reduction)
- >85% of our motorways have silent pavements
- Initial noise reduction single-layer PA16 is 4 dB(A)/
 - two-layer PA8 is 6 dB(A)
- decrease of noise reduction of single layer PA is about 0.2 dB(A),
 - two-layer PA is about 0.33 dB(A) per year
- Ravelling is the most important cause of end of service life of PA16
- Average service life slow lane is 11 years/ fast lane is 17 years.
- Warranty period is 7 years for single-layer PA16(+) and 5 years for two-layer PA
- Promising innovations (Low temp. PA, Acrylic Fibres, Rejuvenation)