



Recycling: Towards a better understanding

NVF, 22 January 2015, Stockholm



Overview

Current situation & trends

Nygen 910

Conclusions





Current situation & trends

Asphalt can be 100% recycled without downgrading its functionality,
It is currently the most recycled construction material in the world.



EAPA Position paper 2014

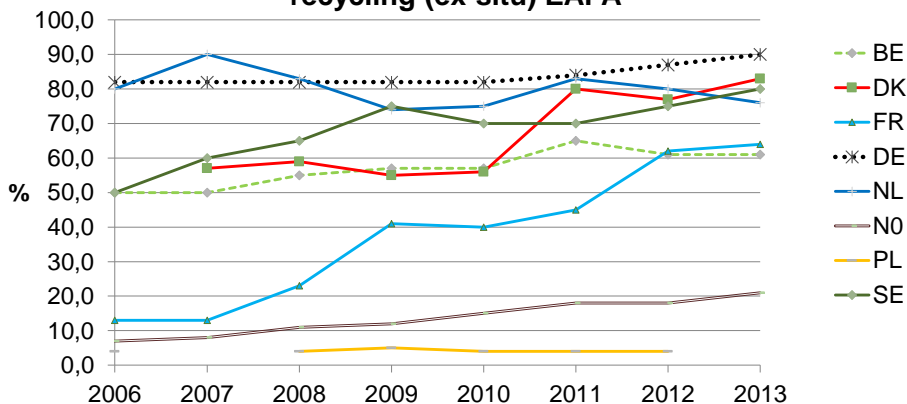
NVF

Jan., 2015



Current situation & trends

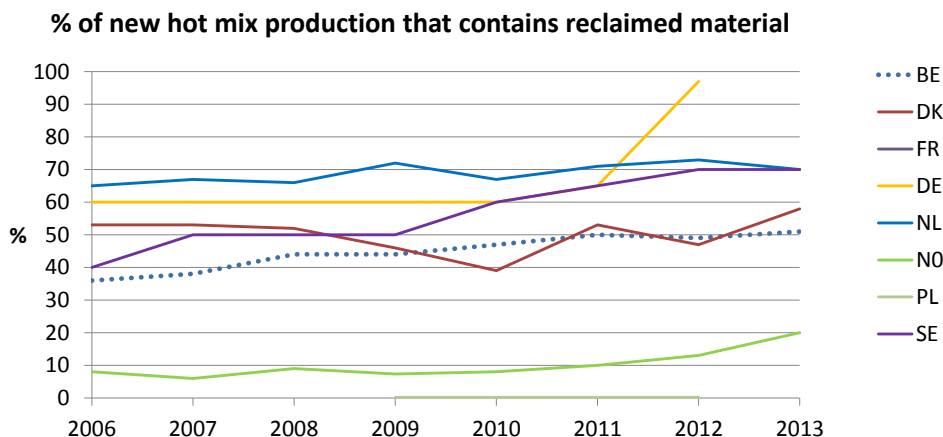
% of available RA material used in hot & warm recycling (ex-situ) EAPA



cold and half-warm recycling are not included: SE, NO, NL used 5%, 15% and 15%
In-situ recycling is not included



Current situation & trends



Current situation & trends

Questionnaire, conducted end 2009, Re-road project,
Author E. Nielsen:

	BE	DE	DK	SE	UK
Average %	AC and base layers, up to 50%	Base: AC: 30%	Base layers: 10-50%	Base layers: 30%,	Base courses: 15-20%
	thin layers, SMA, open asphalt: 0%	Surface: SMA: 0%; AC: 15%	Surface layers: 0%,	Surface layers: 10-15%,	Surface: SMA 0-10%,
				PmB RA: 0-5%	



Current situation & trends

% RA added:

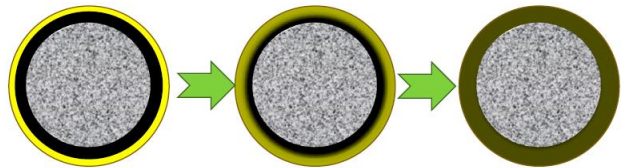
- % RA is very dependent on the asphalt layer and the asphalt type: In most countries RA is not used in surface courses or limited to dense AC.
- Addition rates also depend on:
 - RA characteristics, (homogeneity, recovered binder,)
 - Asphalt plant (feeding possibilities, ...)
- Compared to the max % allowed; the (indicated) average percentages are rather low (5 to 30 %)
- In general, it is accepted that 10% RA can be used without the need to test the resulting mix. For higher RA %, the recovered RA binder is corrected with a softer bitumen.



Blending: old and new - new and old

Black rock

Fully activated binder



-Dependent on:

- mixing temperature (how RA is added: hot or cold)
- mixing time & mixing sequence
- type of RA (from dense or open porous or from base or surface course)
- presence of rejuvenators

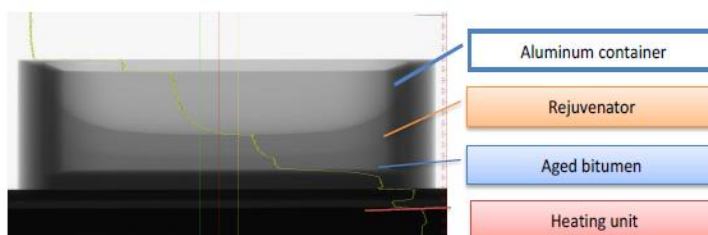
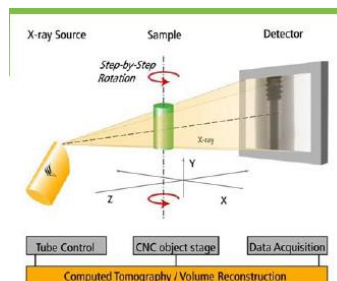
-Do we need 100% blending? On what scale?

-New test methods are being developed

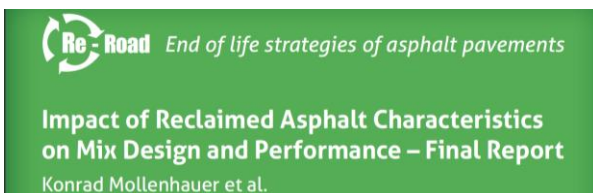


Blending: old and new - new and old

Jian Qui: X-ray tomography
Presented at TU Delft
Recycling symposium 18/09/2014,



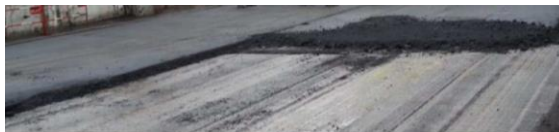
Multiple recycling



The multiple recycling of 50 % RA, after 3 recycling cycles results in an asphalt performance comparable to the properties of SMA mixes containing 100 % virgin material.

- Laboratory study: mixing was performed under optimal laboratory conditions
- Simulated RA was used

(Ongoing activities)



MURE project (France)

www.pnmure.fr

March 2014 - March 2018

How many times can asphalt be recycled?

Multi recycling combined with techniques to reduce the pavement temperature

allback2pave.fehrl.org

Nov. 2013-Nov. 2015,

TU Dresden, University of Nottingham, University of Palermo

How to produce quality asphalt with high RA contents

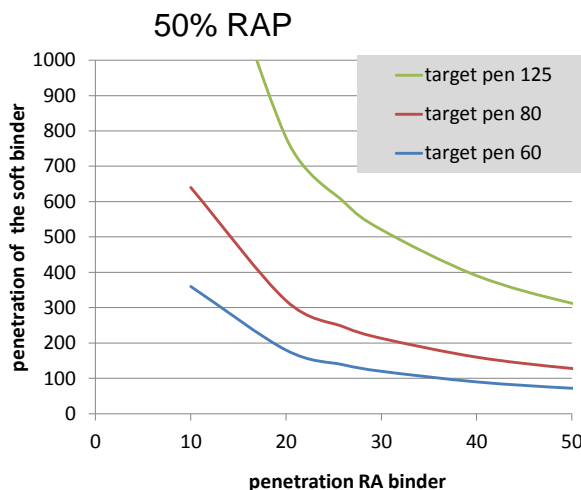


Technical issues related to RA(P) addition into hot mix



► Current general solution for RA asphalts

- Add softer grade to RA to achieve target pen and binder content
 - Limited by
 - Binder target content and pen - only so much can be added
 - Availability of suitable soft grade bitumen for blending
- Even 30% addition of RA may be problematic with available tankage

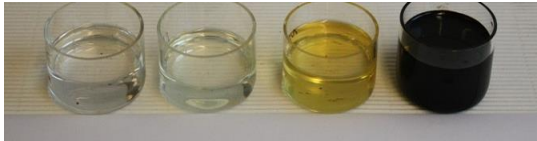




Nygen 910 - Nynas project

▶ Brief scope of project

- ▶ Several different bitumens and oils evaluated
 - ▶ Vegetable, Tall, Paraffinic and Hydrocarbon oils

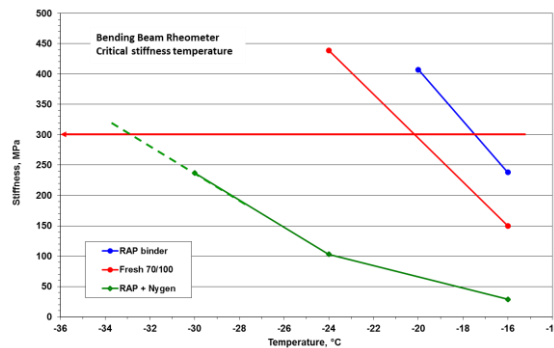


- ▶ Blended into recovered binders for full rheological and performance characterisations
- ▶ Laboratory work complemented by site trials in UK, Netherlands, Sweden and Finland
- ▶ Nygen 910 identified as best all round solution

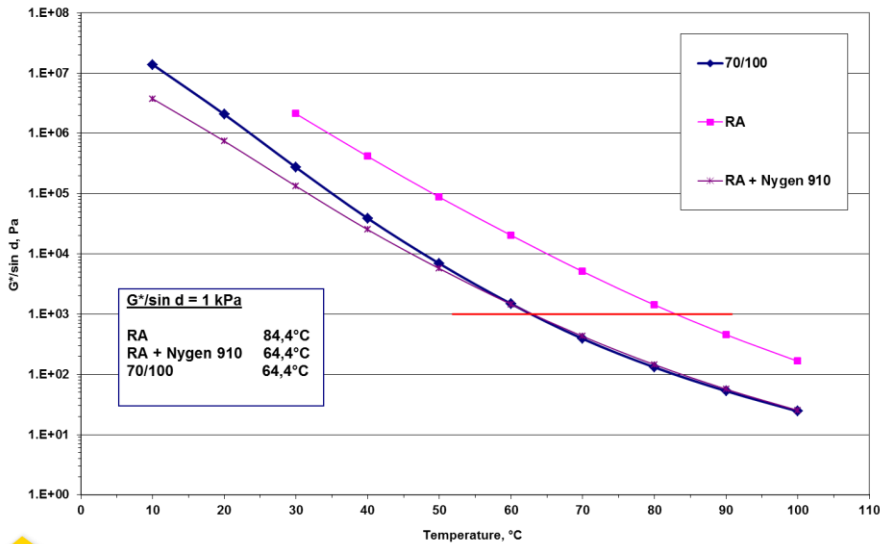


Nygen 910 key RA blend benefits

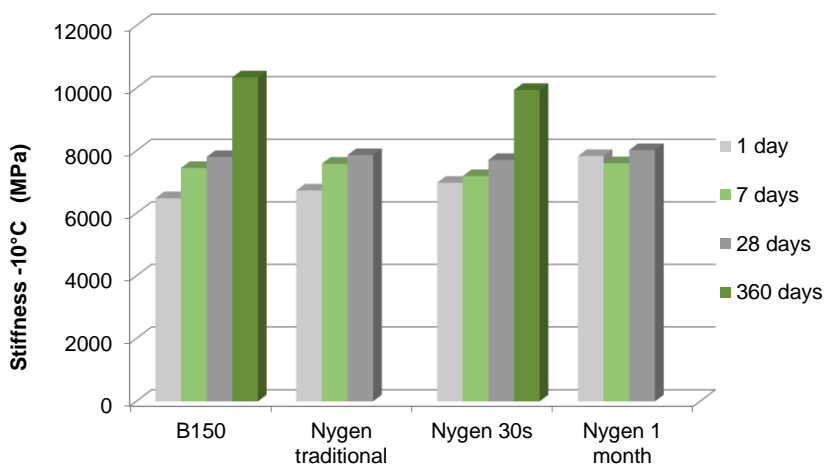
- ▶ Improved low temperature properties compared to virgin and RA + virgin blends
 - ▶ Lower rate of change in stiffness at low temperature
 - ▶ Implies less brittle
- ▶ Equivalent performance at high temperatures
- ▶ Effective at low dose rates



High Temperature Properties : SHRP Original Rutting Parameter



Method of Nygen 910 addition





Nygen 910 key RA blend benefits

- ▶ Safe.
 - ▶ Product is not classified as dangerous according to Directive 67/548/EEC
 - ▶ Flash point > 210°C
- ▶ Ease of handling and mixing
 - ▶ Easily pumped. No specialist equipment necessary
 - ▶ Low pour point (<-20°C)
- ▶ High thermal stability
 - ▶ Maintains performance at elevated temperatures



Conclusions

- A high percentage of available RAP is recycled:
NL, DE, SE, DK are > 75%

For high RAP contents:

- Adding soft binder alone is not sufficient
- The degree of blending
- (Self) healing and aging characteristics
- Use of RA containing PMB (reactivate the polymer)
- Re-recycling
- Generalization (test the most severe conditions)





Thank you

