

## Recycling management towards high quality and circular re-use of porous asphalt and SMA layers: a Dutch perspective

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## AsfaltNu, Dutch market leader in asphalt

- Shareholders:  
BAM (1<sup>st</sup> Dutch contractor) and Heijmans (5<sup>th</sup> Dutch contractor)
- The **biggest** asphalt producer in NL
- **7x** asphalt plants (6x WMA-plants, **7x in 2025**)
- **1,9 mln** tons in 2021 (market share of 25-30%)



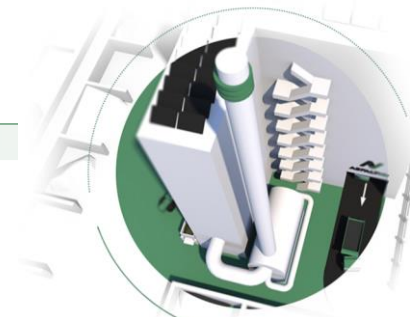
# AsfaltNu, frontrunner in sustainability

## Ambition:

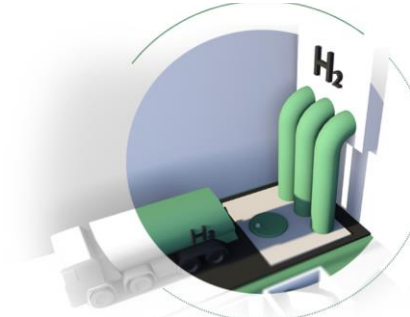
100% circular and sustainable asphalt industry

## Strategy:

Development of climate neutral, energy neutral, circular and sustainable asphalt mixtures and production techniques



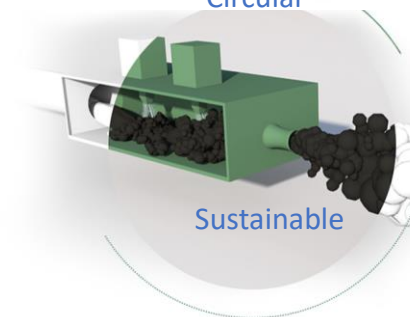
Climate neutral



Energy neutral



Circular



Sustainable



## Re-use of PA and SMA

- Situation Dutch pavement industry:
  - ~14% new projects, ~86% maintenance
  - Almost perpetual design, wearing courses have relatively shorter lifespan:
    - PA 8-15 years; SMA 15-20 years; AC surf: 20+ years; bin/base layers: 40+
  - High quality bitumen and mineral aggregates (PSV >58! for motorways) in PA and SMA
- Re-use of PA and SMA is thus interesting and important, with enough challenges
  - Concerns about quality and homogeneity
  - Concerns about availability
  - Concerns about process management

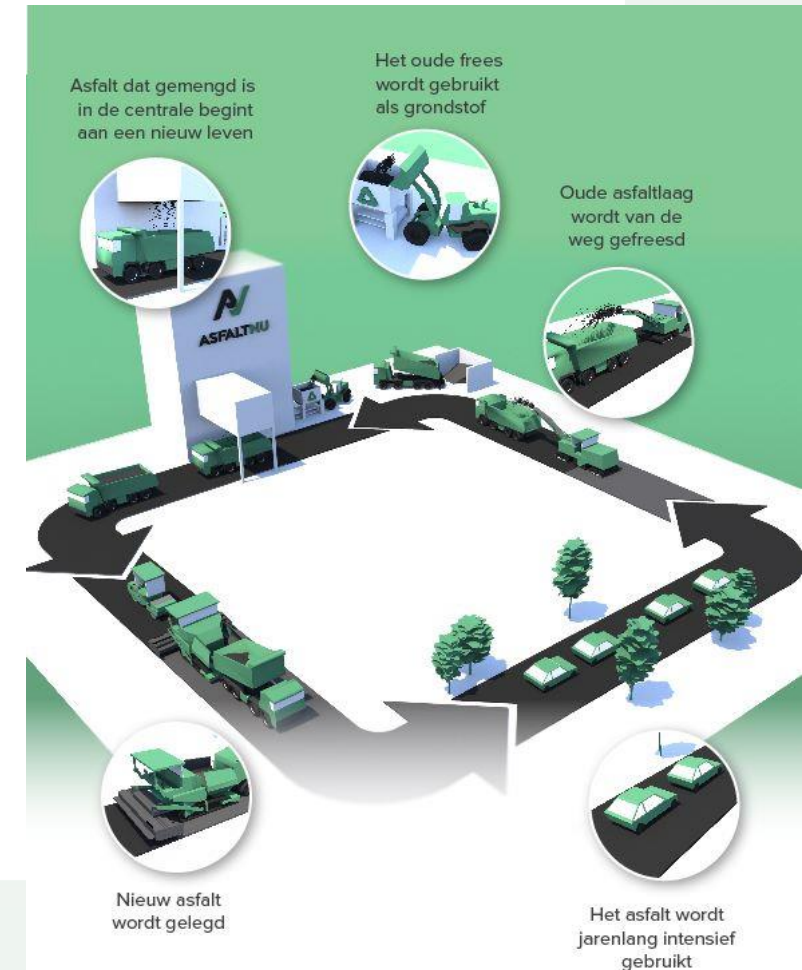
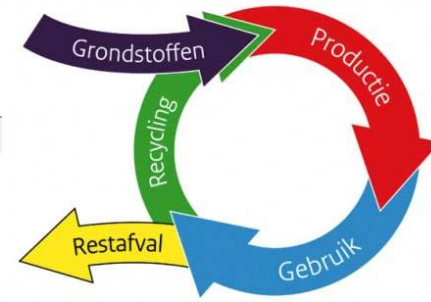
→→ We need to do **urban mining** instead of recycling!

# Urban mining is much more than recycling

A holistic approach is needed, with following steps

- 1) Systematic thinking, inventarization and a good plan
- 2) Intelligent milling (harvesting)
- 3) Processing reclaimed materials into high quality construction materials
- 4) High quality rejuvenation
- 5) Production and construction into new asphalt layers

*Step 1-3 will be discussed in this presentation*



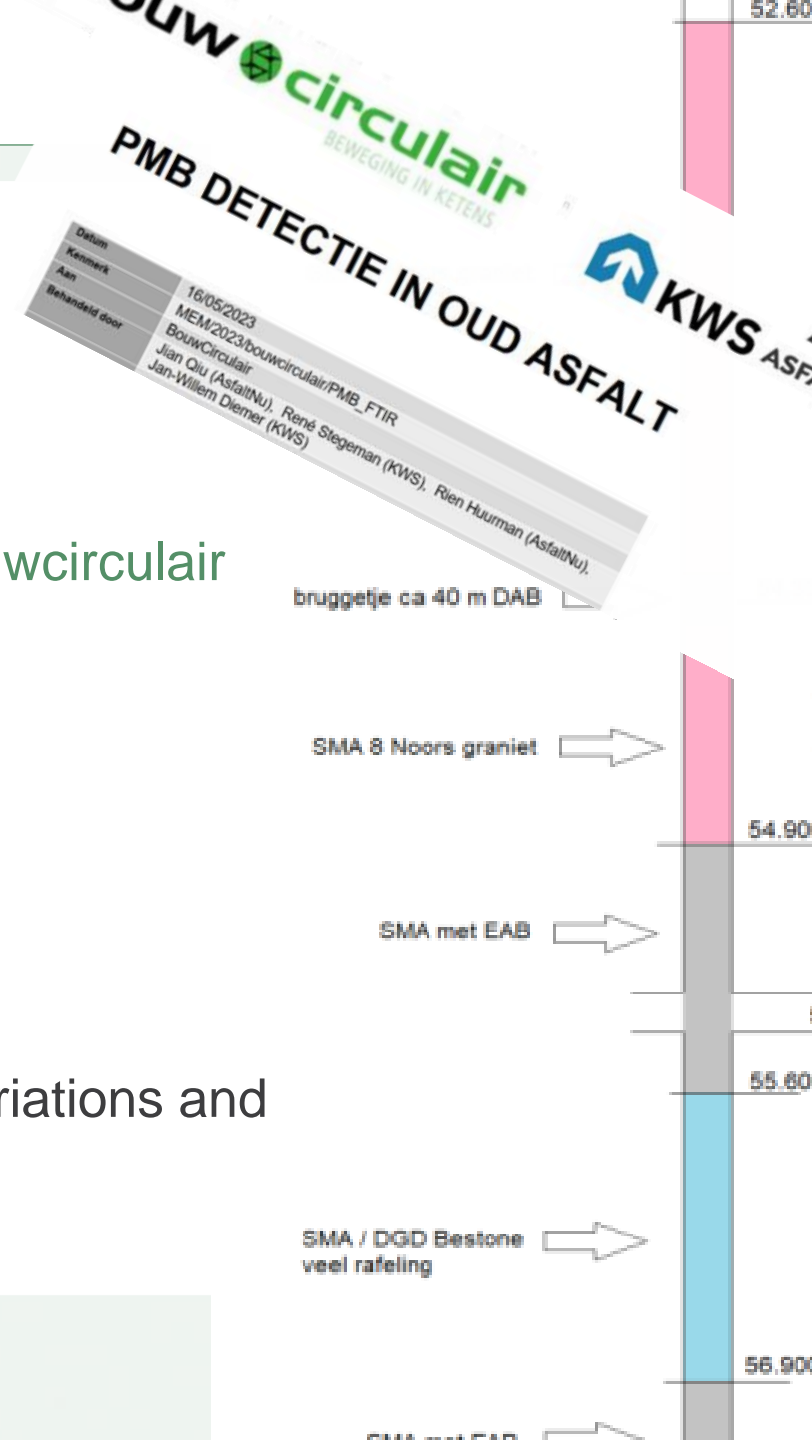
# Urban mining: step 1 inventarization

## Inventarization of type materials

- Type bitumen
  - Pen bitumen or PMB? Which type? → protocol Bouwcirculair
- Type mineral aggregates
  - Aggregate information (type)
  - Skid resistance
  - Density

## Inventarization of homogeneity of sections

- Type surface layers (SMA, AC, DGD, PA), thickness variations and conditions
- Macro-inhomogeneity: reparations, surface treatment..

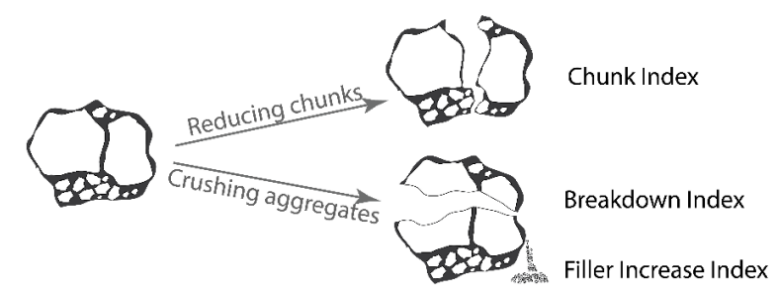


## Urban mining: step 2. harvesting (1/2)

### Example, Project A326 SMA to SMA

- Good pre-treatment rewards in good quality, removing road markings, reparations
- Attention to variations in thickness (be careful of binder layers!)
- More time and space in the planning to ensure proper harvesting

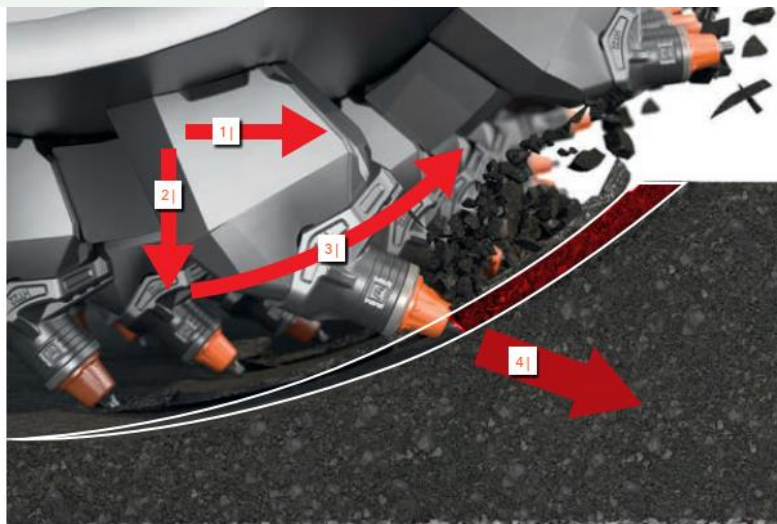




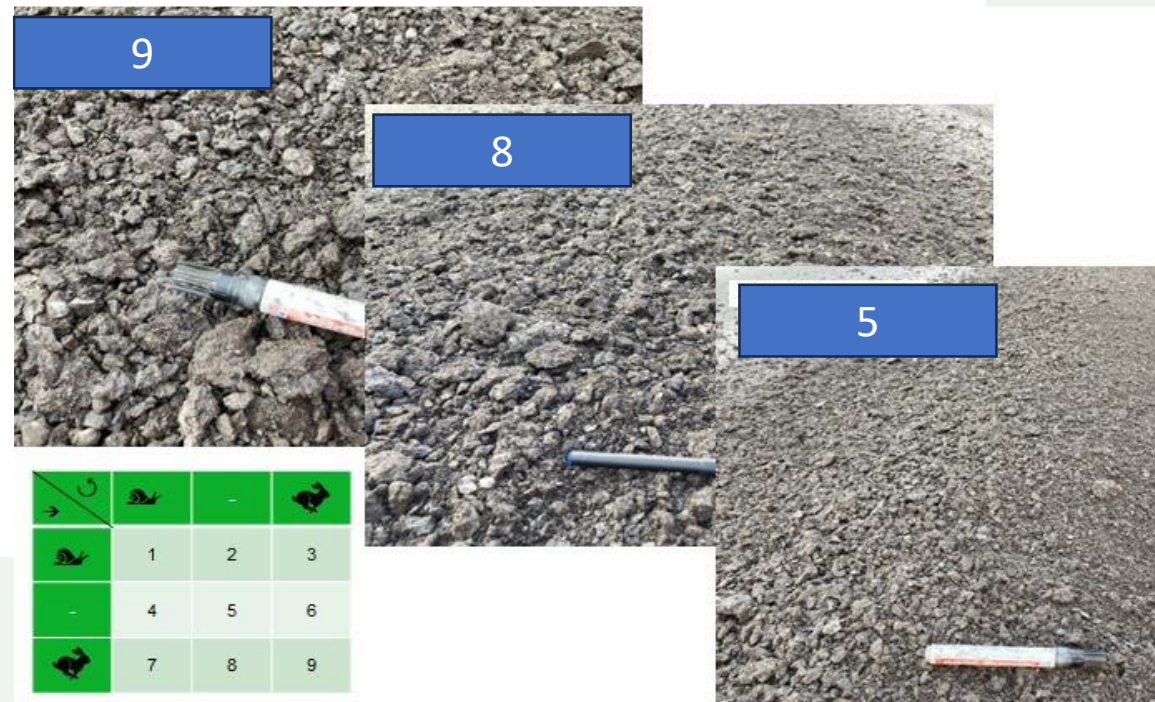
## Urban mining: step 2. harvesting (2/2)

Example, project intelligent milling SMA, partner BAM, Heijmans and Freesmij

- What are the best parameters for harvesting?
- Harvesting good materials: low chunk index and low crushing (breakdown) index according to EMPA
- A good remaining texture after milling



1| Traction force  
2| Force of machine weight  
3| Force of milling drum rotation  
4| Resulting cutting force

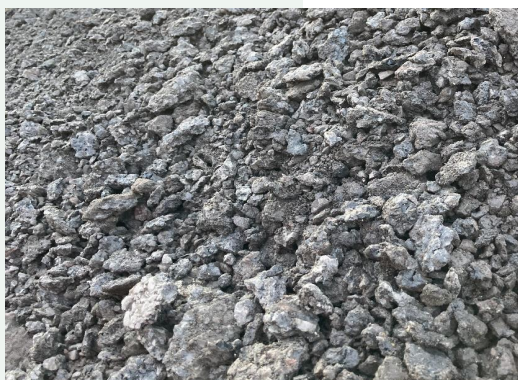




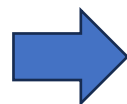
# Urban Mining: step 3. processing



Method of processing	Control of the grading (macro-homogeneity)	A smaller chunk index (micro-homogeneity)	A smaller crushing index (less breakdown)	Advise % course fractions in SMA and PA mixtures
None	--	-	o	0%
Sieving	o	o	o	Up to max. 30%
Light crushing (kneuzen)	+	++	-	Up to max. 60%
Decomposition (scheiden)	++	+++	--	Up to max. 80%, or replacing all aggregates



RAP materials



Kneuzen fractions



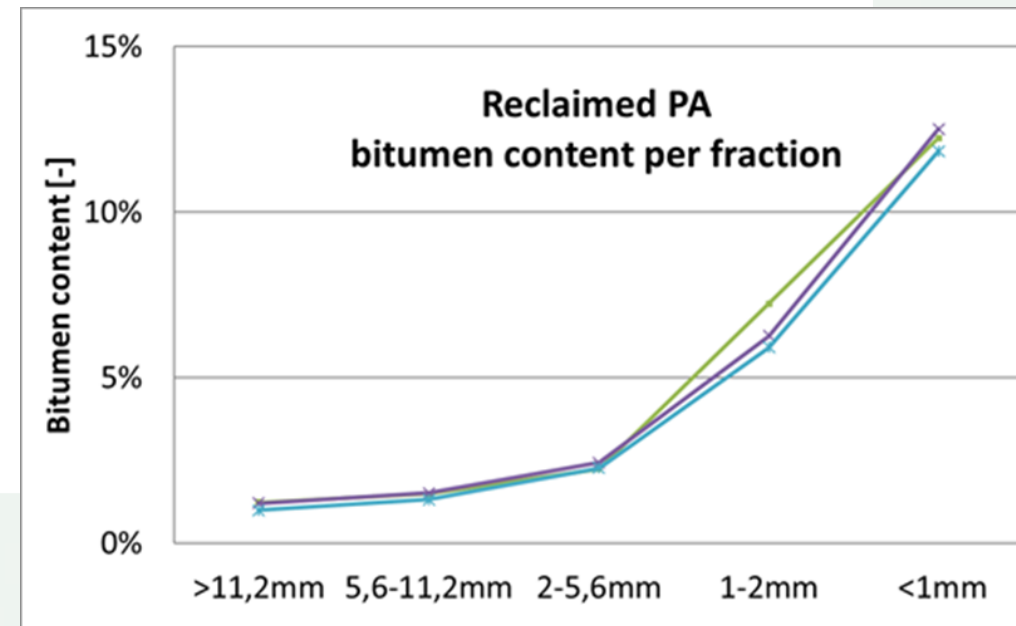
Decomposition fractions

## Urban Mining: takeaways

- Quality of the coarse RA-materials can be managed
- Homogeneity of coarse RA-materials can be managed
- Process and logistic: availability, material balance and harvesting rate
  
- But...

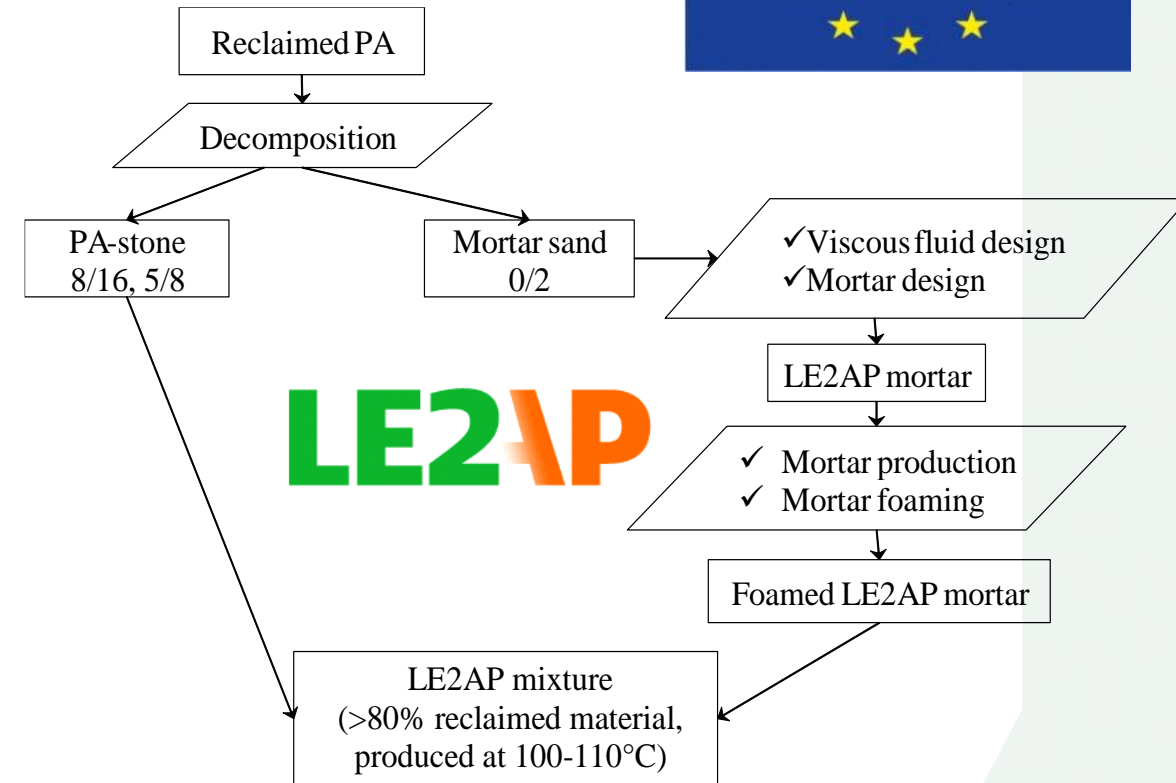
What shall we do with the fine fractions??

- the reclaimed mortar 0/5 or 0/2
- mostly 7-12% bitumen
- mixture of sand, filler and bitumen



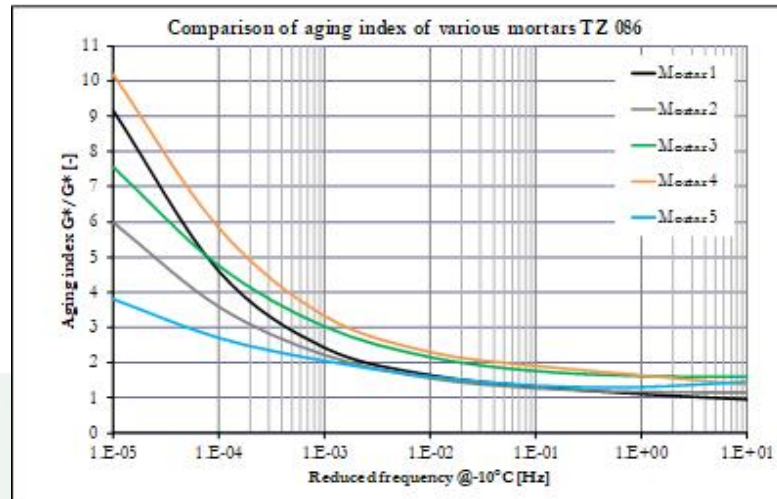
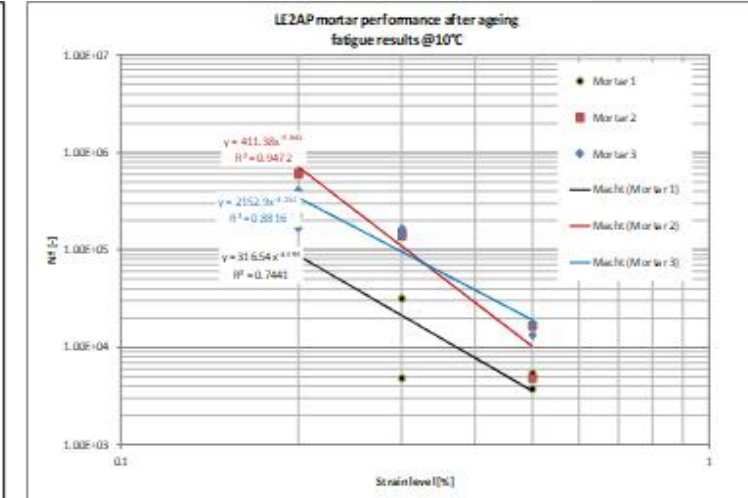
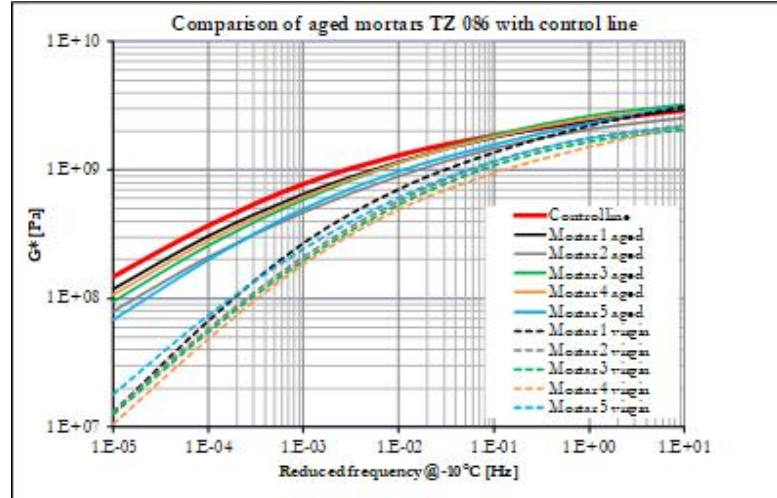
## The LE2AP technology

- European LIFE+ (2013-2016), LE2AP (Low Emission2 Asphalt Pavement)
- Reclaimed mortar sand
  - <2 mm, 10-12% bitumen
  - heating- rejuvenating- enriching- homogenizing- foaming
- Together with reclaimed stone to produce mixture with 95% reuse @100-110°C



# Designing of a LE2AP mortar

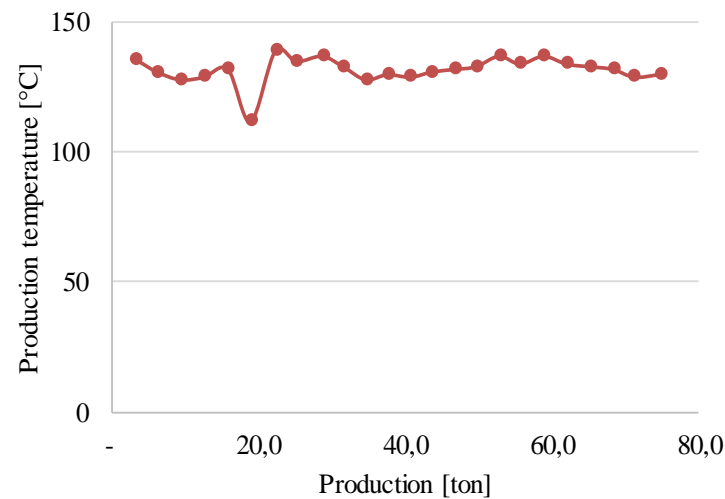
- Rheological evaluations
- Fatigue performance
- Aging resistance



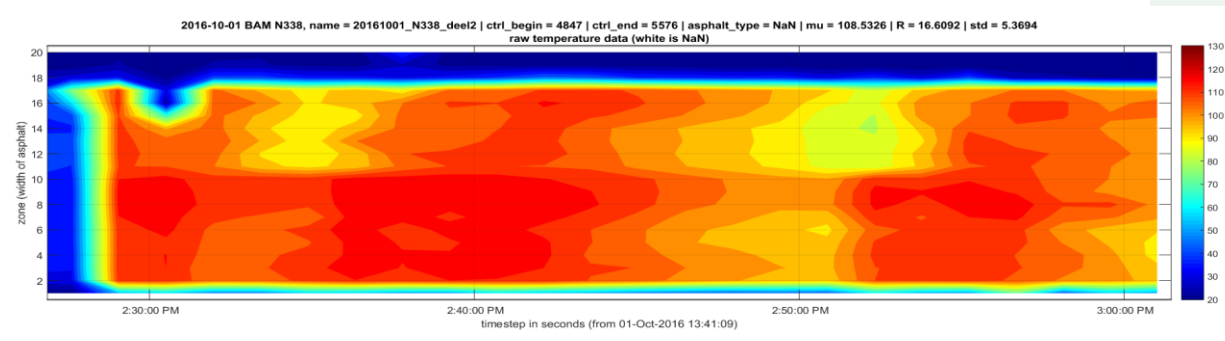
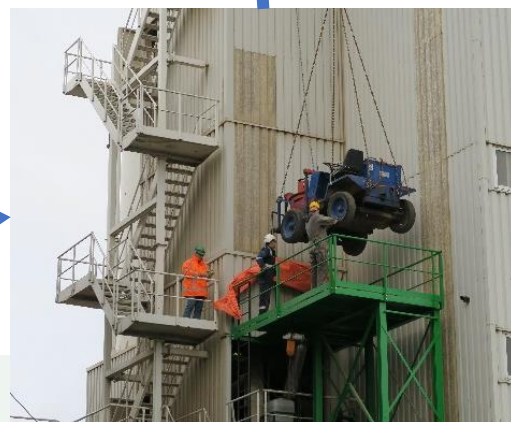
# Laboratory production of a LE2AP mortar



# Industrialization phase I proof of concept (20 ton mixture/hour)



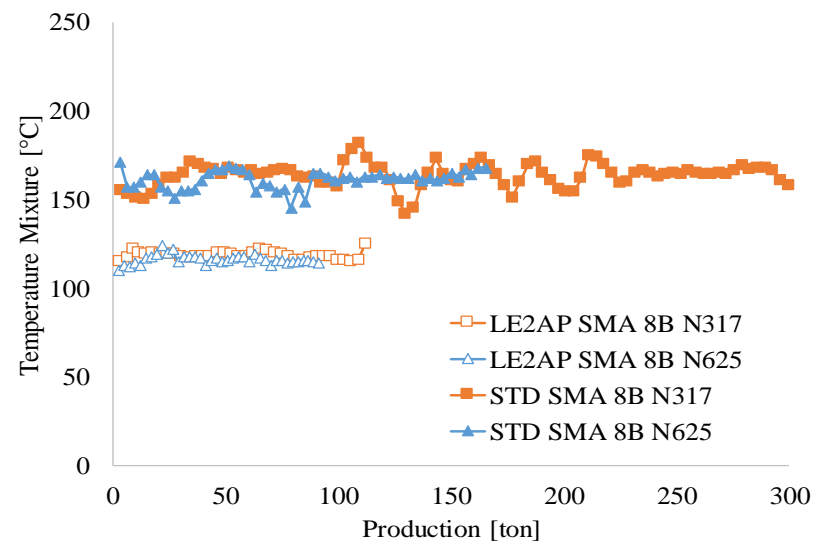
**N338 2LPA 16 Province Gelderland (2016)**



# Industrialization phase II optimization (75 ton mixture/hour)



**N625 Noord Brabant (2018)**  
**N317 Provincie Gelderland (2018)**



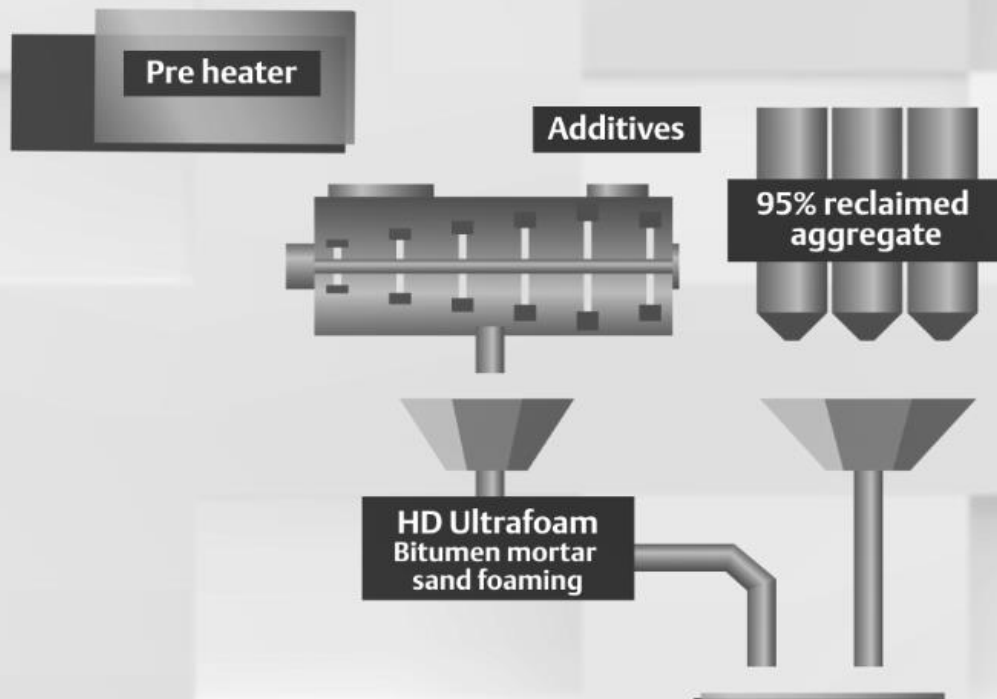
**A73, 2LPA 16, RWS (2020)**



	N317			N625		
	Average production speed [ton/hour]	Average temperature mixture [°C]	Standard deviation of temperature [°C]	Average production speed [ton/hour]	Average temperature mixture [°C]	Standard deviation of temperature [°C]
<b>LE2AP SMA 8B</b>	74	118	2	75	116	3
<b>STD SMA 8B</b>	136	163	7	118	158	23

# Industrialization phase III full industrialization (100-150 ton/hour continuous)

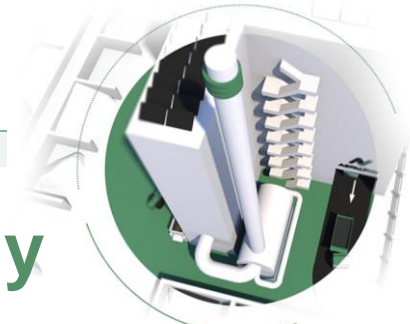
More information will be available in 2025!





# Sustainability asks urgently for integrated technology

- Asphalt plant of the future: integrated (asphalt) technology regarding circular, climate neutral (no process emissions), energy neutral, and sustainable (durable)
- CROW Asfaltkwaliteitsloket, validation of non-standard technologies based on TRL-levels



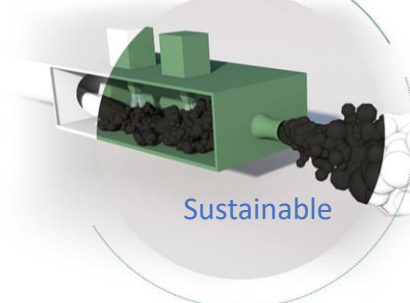
Climate neutral



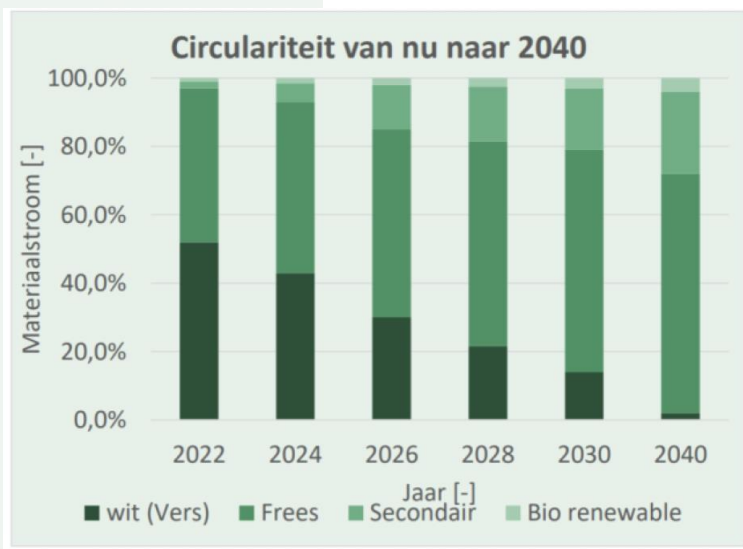
Energy neutral



Circular



Sustainable



**Certificaat** **Asfaltkwaliteitsloket**  
**CROW**

Het Asfaltkwaliteitsloket, ondergebracht bij het kennisplatform CROW, verklaart hierbij dat de claims:

- Door het gebruik van de LEAB-systeematiek wordt gemiddeld 30% minder CO<sub>2</sub> uitgestoten

**LEAB**<sup>®</sup>

LEAB, low temperature asphalt concrete of AsphaltNu, validation level TRL-9!

Namens de Stuurgroep Asfaltkwaliteitsloket CROW



Technologies to be developed to eliminate burning of bitumen in the recycling drum

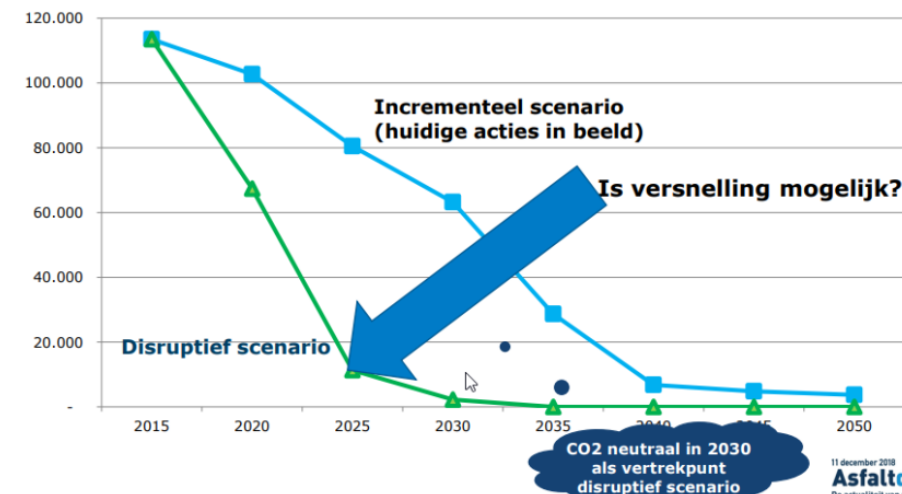
# Sustainability asks also urgently for impacts

## Klimaatneutraal en circulair werken op onze rijkswegen in 2030

- 100% CO<sub>2</sub>-reductie
- hoogwaardig hergebruik van alle materialen
- halvering van het gebruik van primaire grondstoffen



## RWS interne studie Is versnelling CO<sub>2</sub> reductie mogelijk?



NOS NIEUWS • BINNENLAND • MA 20 FEBRUARI, 12:05

## IPCC: gevolgen klimaatverandering steeds erger; 'nu razendsnel aan de slag'



Extreme droogte, bosbranden en overstromingen nemen toe door klimaatverandering. AFP

Net binnen Algemeen Economie Sport Tech Media en Cultuur Achterklap

Maandag 13 september 2021 | Het laatste nieuws het eerst op NU.nl



## Nederland aan zet voor hoger klimaatdoel, liefst vóór klimaattop Glasgow

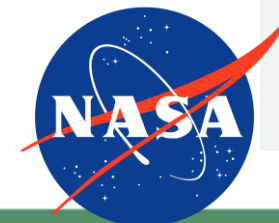
13 september 2021 05:47  
Laatste update: 3 uur geleden

844 NUjij-reacties

Rijkswaterstaat brings out disruptive approach to accelerate the transition!

# A car with two steering wheels

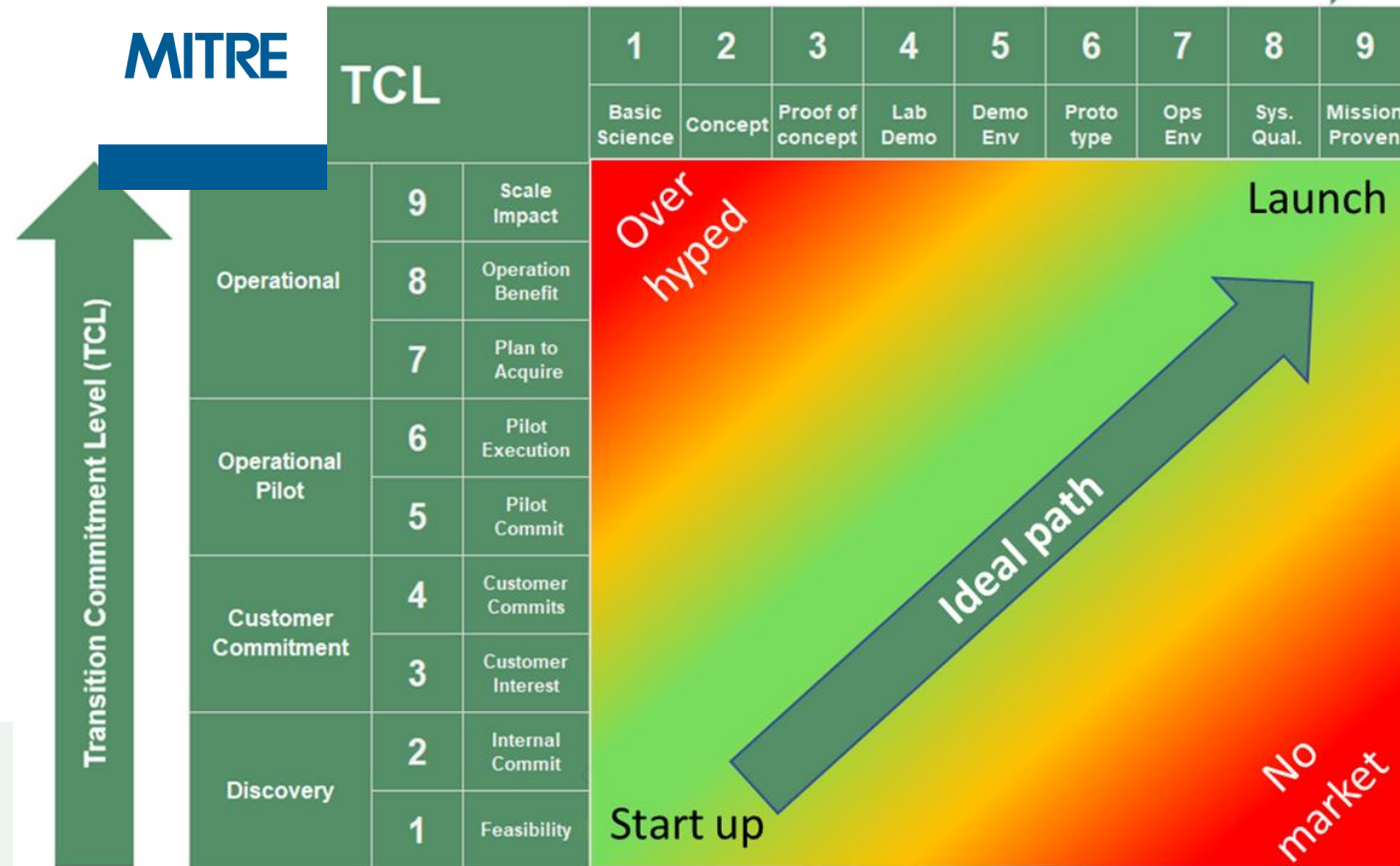
- Technology Readiness level (TRL)
- Transition commitment level (TCL)



Gradient Level			
Very High Risk	Higher Risk	Higher Risk	Lower Risk



**MITRE**



Transition Commitment Level (TCL)

Over hyped

Launch

Ideal path

Start up

No market

# TRL-TCL: frontrunner approach of Rijkswaterstaat, an example

## Koploeraanpak duurzaam asfalt Transitiepad wegverharding



Rijkswaterstaat  
Ministerie van Infrastructuur en Waterstaat



### Koploeraanpak

Om als gehele sector sneller te leren, stellen we bij enkele projecten extra ambitieuze eisen aan duurzaamheid op basis van wat de markt kan leveren. Dit noemen we koploerprojecten.

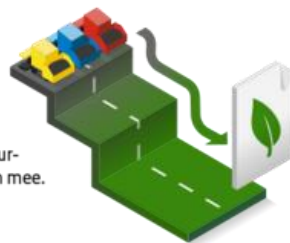
### Ambitie

In 2030 werken we in de hele asfaltketen klimaatneutraal met de helft minder gebruik van primaire grondstoffen. Daarbij sturen we op het verminderen van milieukosten.



### Pelotonaanpak

Door op alle projecten steeds duurzamer asfalt te eisen, verduurzamen ook andere marktpartijen mee.



### Innovatie en validatie

We schrijven prijsvragen uit en creëren meer testcapaciteit. We werken alleen met goedgekeurde asfaltmengsels.



### Actieplan milieubeprijzen

We geven milieukosten (MKI-waarde) meer gewicht in de gunningscriteria. Bij alle projecten nemen we milieukosten op in de aanbestedingen.

Koploeraanpak



**Projectselectie**  
Koploerprojecten hebben relatief veel asfalt en zijn regionaal verspreid.



**Marktconsultatie**  
Partijen geven de MKI-waarde aan van hun asfaltmengsels. Wij passen onze eisen hierop aan en nemen deze op in het contract.



**Project-specifiek**  
We kijken per project hoe ambitieus we de eisen kunnen stellen om zo duurzaam mogelijk asfalt in te kopen.



**Voldoende concurrentie**  
We zorgen ervoor dat minstens drie partijen aan de ambitieuze duurzaamheidseisen kunnen voldoen.



**Gunning**  
Koplopers krijgen de ruimte om de meest duurzame mengsels aan te bieden zonder zichzelf uit de markt te prijzen.

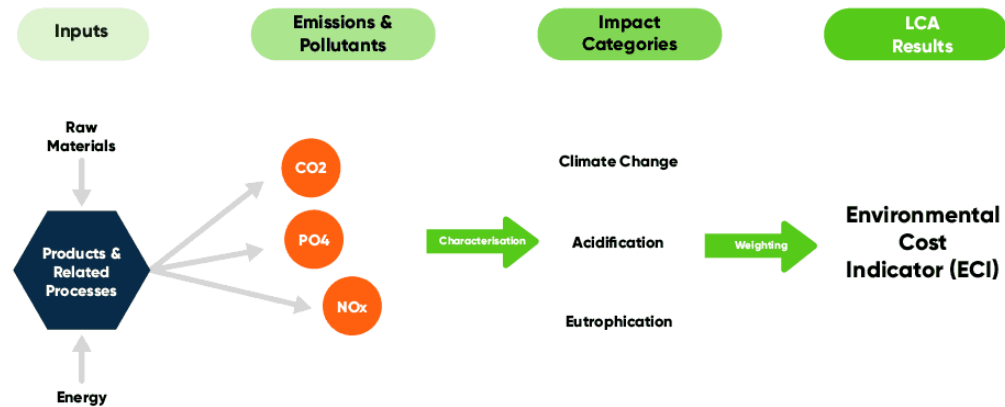


**Monitoren en bijsturen**  
We blijven met elkaar in gesprek, evalueren regelmatig en houden in de gaten of we op koers liggen om ons doel te bereiken.

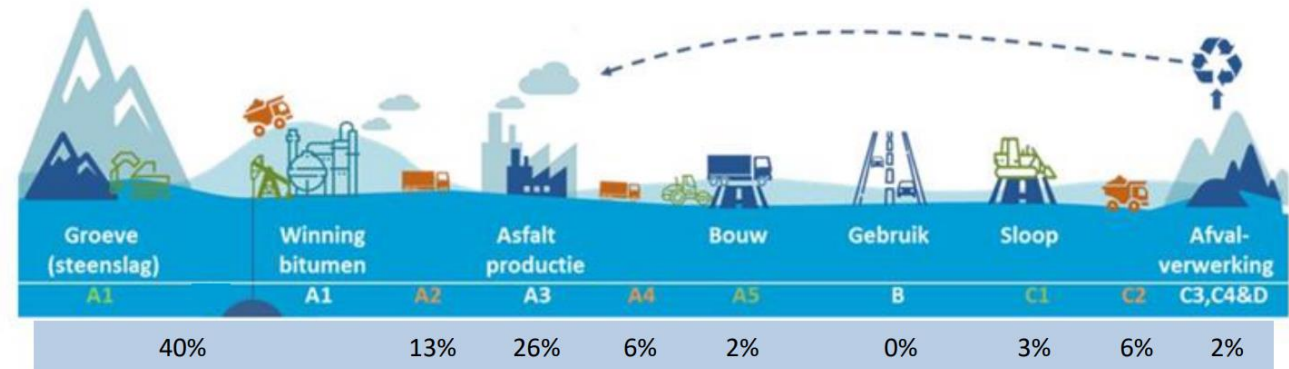
# Sustainability evaluation using LCA-analyse

- About **50%** of Dutch tenders/contracts have sustainability components (BPKV=Best Price Quality Ratio)
- Goal in 2030, **100%** of contracts with sustainability components (BPKV)
- An important BPKV-criteria based on LCA,

**MKI (MilieuKosten indicator, Dutch) = ECI (Environmental Cost Indicator)**

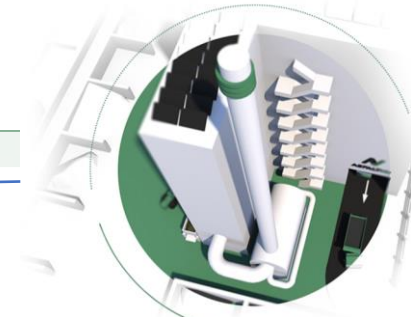


Figuur 3: CO<sub>2</sub>-eq uitstoot 2021 in de asfaltketen<sup>2</sup>



# Winning sustainable tenders, an example

Contractor	Price (a)	MKI/ECI value	Sustainability discount BPKV based on ECI (b)	End price (a+b)	Ranking based on (a+b)
1	€ 10.000.000	933.938	€ -2.441	€ 9.997.559	3
2	€ 10.500.000	646.986	€ -662.101	€ 9.837.899	2
3	€ 10.700.000	500.000	€ -1.000.000	€ 9.700.000	1



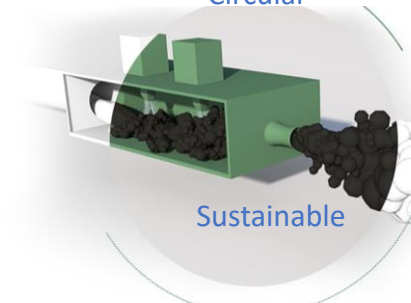
Climate neutral



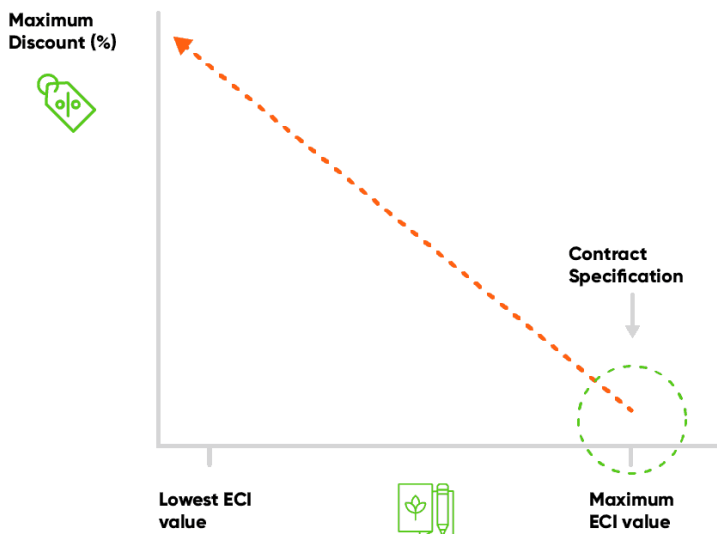
Energy neutral



Circular



Sustainable



- Lowest ECI values corresponds to highest sustainability discount BPKV (b), 1 ECI unit equals sometimes **€10** or even up to **€50!**
- Ranking based on price+sustainability discount (a+b), **Contractor 3** wins this sustainable tender

## Results of the frontrunner approach

- BPKV as strong components for sustainable asphalt!
- 4x large scale maintenance projects of RWS,
- We have been **3x!** selected as favourite contractors
- **Innovation pays off!**



A2/A12 project Heijmans, near Utrecht

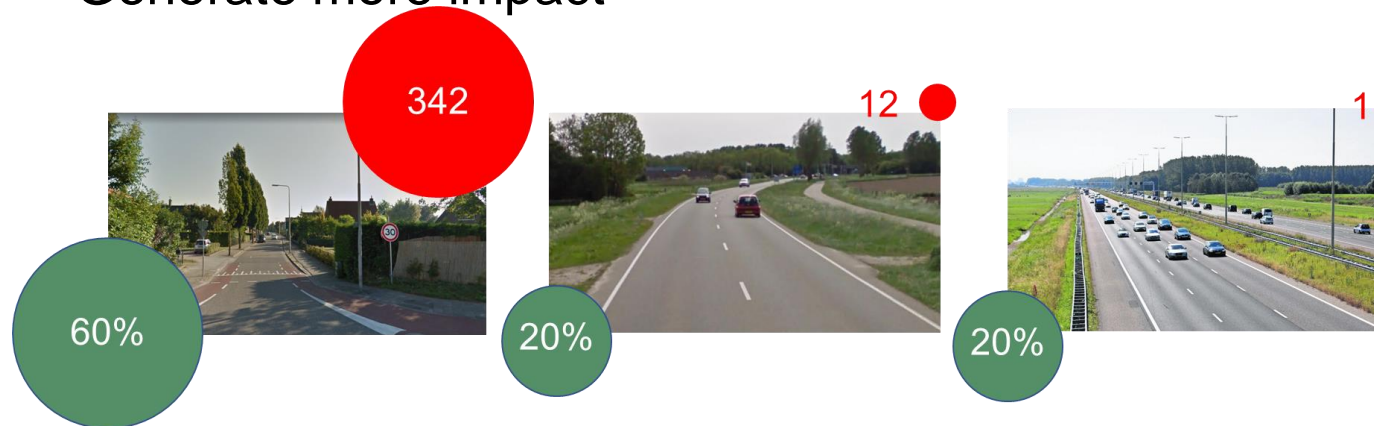


A1/A10 project BAM, near Amsterdam

# The sustainable future

## In 2025!

- WMA is the norm for Dutch asphalt (and we are ready!)
- Industrialization of the mortar line
- Generate more impact

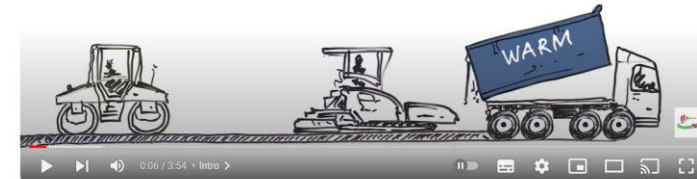


## The near future...

- Urban mining as daily business
- Asphalt centrale of the future with integrated technologies

## Uiffaseren hotmix asfalt (HMA)

- Vanaf 2025 is warm mix asfalt (WMA) de norm
- WMA is asfalt met een temperatuur <140°C



Wegen steeds vaker gelegd met Warm Mix Asfalt: opdrachtgevers en opdrachtnemers gaan voor duurzaam

Koninklijke Bouwend Nederland  
822 abonnees

Abonneren

6 6 Delen Downloaden



Thanks for your attention!

