A sustainable procurement strategy for road infrastructure

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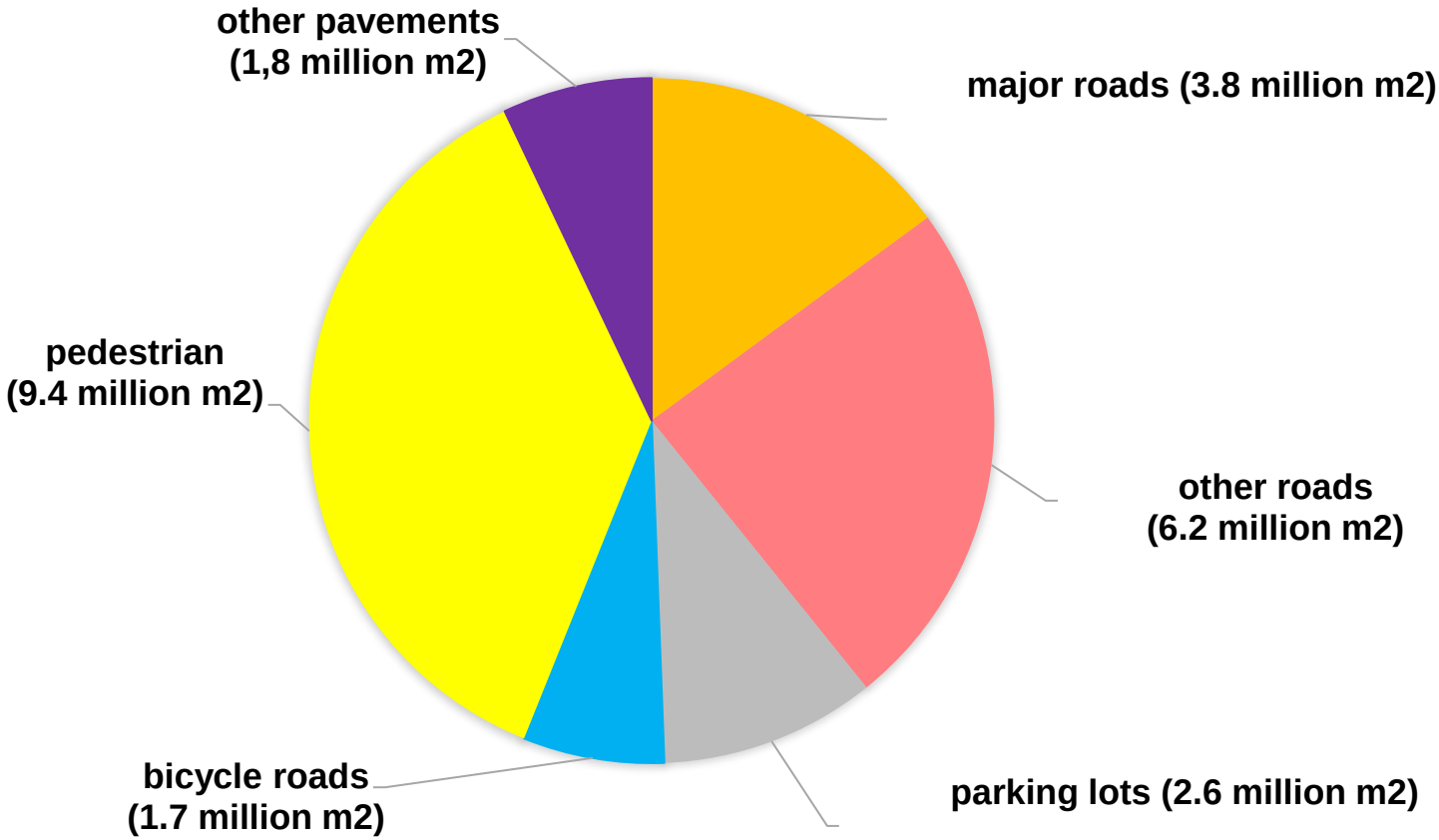
bigbuyers for climate & environment

Gemeente Rotterdam

Road types in Rotterdam (asphalt 25%)




Prins
6.1

Framework agreement asphalt maintenance

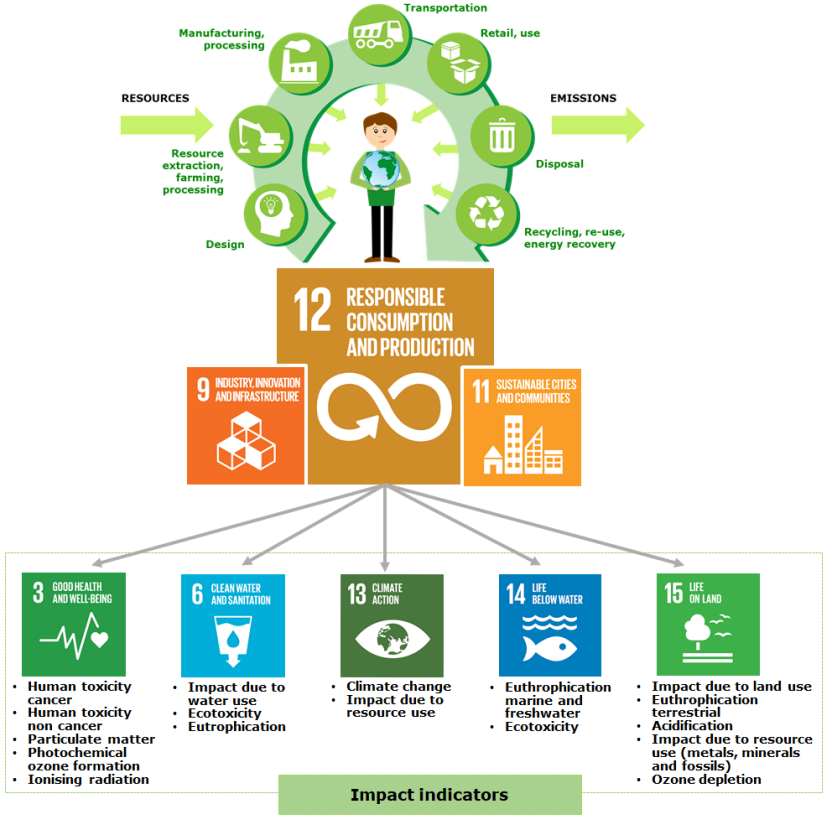
- European Public Tender (1-W-14177-21)
- Duration: 2 years + 2 optional years
- Contract start date: January 2023
- Value of contract: € 40 million
- Objective: regular road maintenance including resurfacing, reconstruction, carriageway markings and all associated traffic and pedestrian management
- 600.000 tons of asphalt included
- 2 lots, one of them dedicated to innovation and sustainability
- 6 contractors (5 SME’s)

Innovation Procurement Approach

Objective: minimising environmental damages through an **innovation challenge** that lead to cost-effective abatement (including circular techniques) both at the construction site and within the supply chain while avoiding construction durability risks

Approach: focusing on **contractual outcomes** using a set of indicators without prescribing specific solutions to accomplish them

Instrument: awarding bids using an **environmental cost indicator (ECI)**– a monitised value based on a life cycle assessment of construction materials used within a project



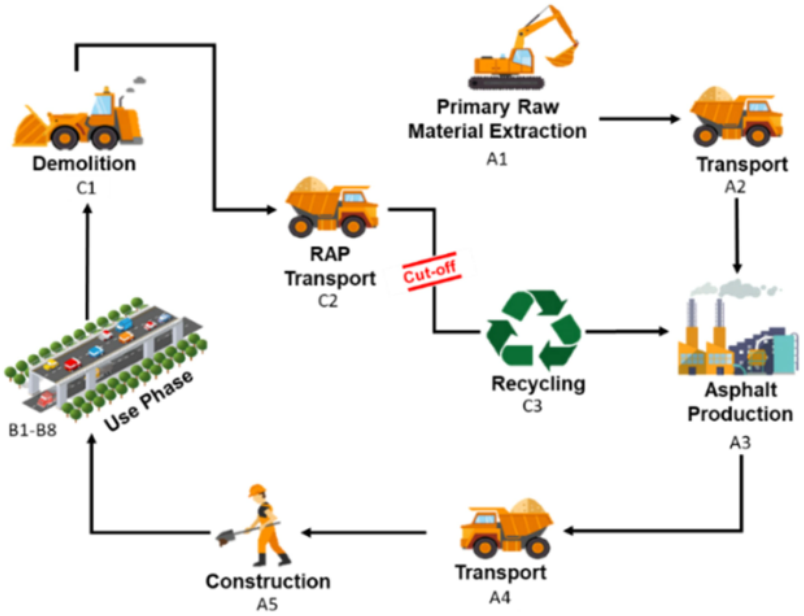
Source: https://eplca.jrc.ec.europa.eu/sustainableConsumption.html

Impact category	Unit	Weighting of results
Climate change – total	kg CO2-eq.	
Climate change – fossil	kg CO2-eq.	
Climate change – biogenic	kg CO2-eq.	
Climate change – land use and change to land use	kg CO2-eq.	
Ozone layer depletion	kg CFC11-eq.	
Acidification	mol H+-eq.	
Freshwater eutrophication	kg PO4-eq.	
Seawater eutrophication	kg N-eq.	
Land eutrophication	mol N-eq.	
Photochemical ozone formation	kg NMVOC-eq.	
Depletion of abiotic raw materials, minerals, and metals	kg Sb-eq.	
Depletion of abiotic raw materials Fossil fuels	MJ, net cal. val.	
Water use	m3 world eq.	
Fine particulate emissions	Illness incidence	
Ionizing radiation	kBq U235-eq.	
Ecotoxicity (freshwater)	CTUe	
Human toxicity, carcinogenic	CTUh	
Human toxicity, non-carcinogenic	CTUh	
Land-use related impact/soil quality	Dimensionless	

Single-score indicator

Source: Nationale Milieudatabase, https://milieudatabase.nl/en/environmental-performance/environmental-performance-calculation/

Key Environmental Indicators



Energy usage during production

Polycyclic Aromatic Hydrocarbons (PAH), NOx and PM

Bitumen, granulates

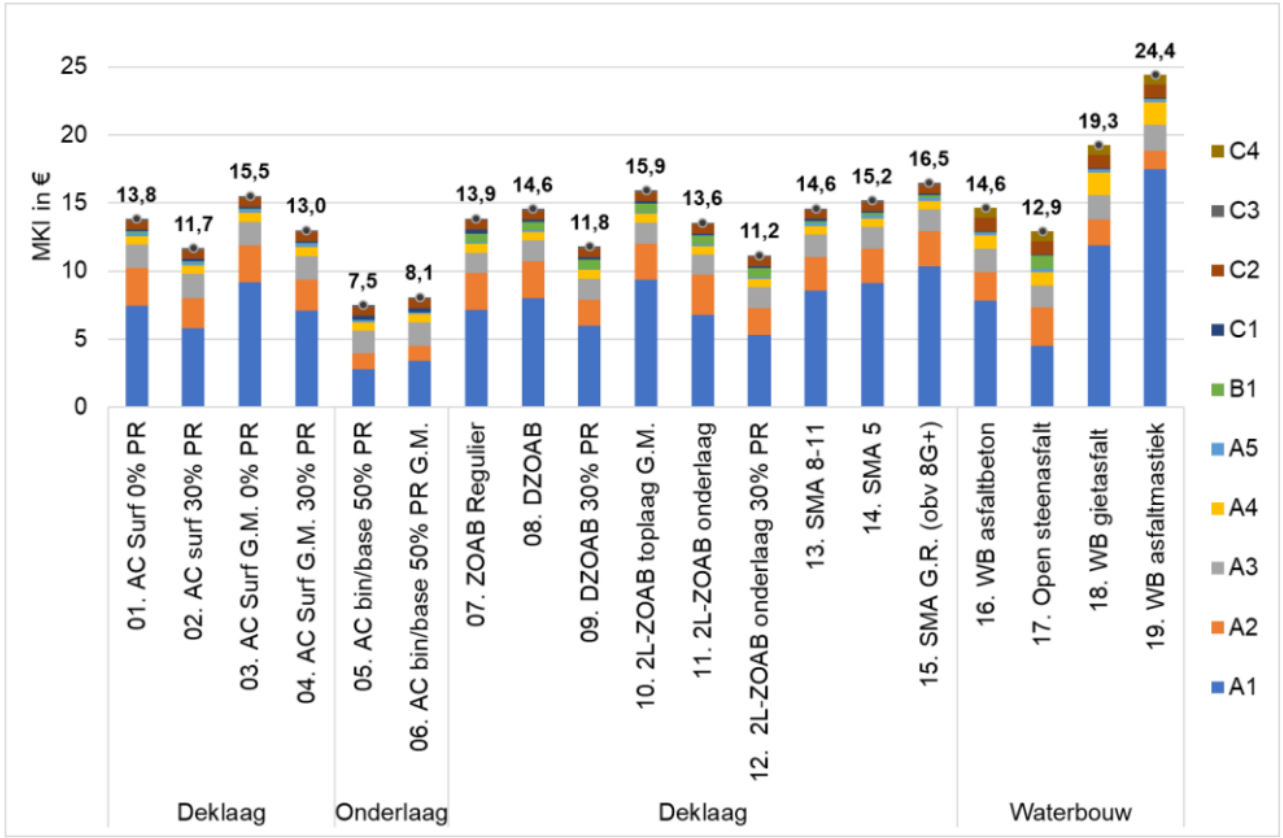
Global Warming Potential

Human Health and Ecosystems Quality

Abiotic Resource Depletion

Source: Siverio Lima et.al (2021). Determining the Environmental Potentials of Urban Pavements by Applying the Cradle-to-Cradle LCA Approach for a Road Network of a Midscale German City, MDPI

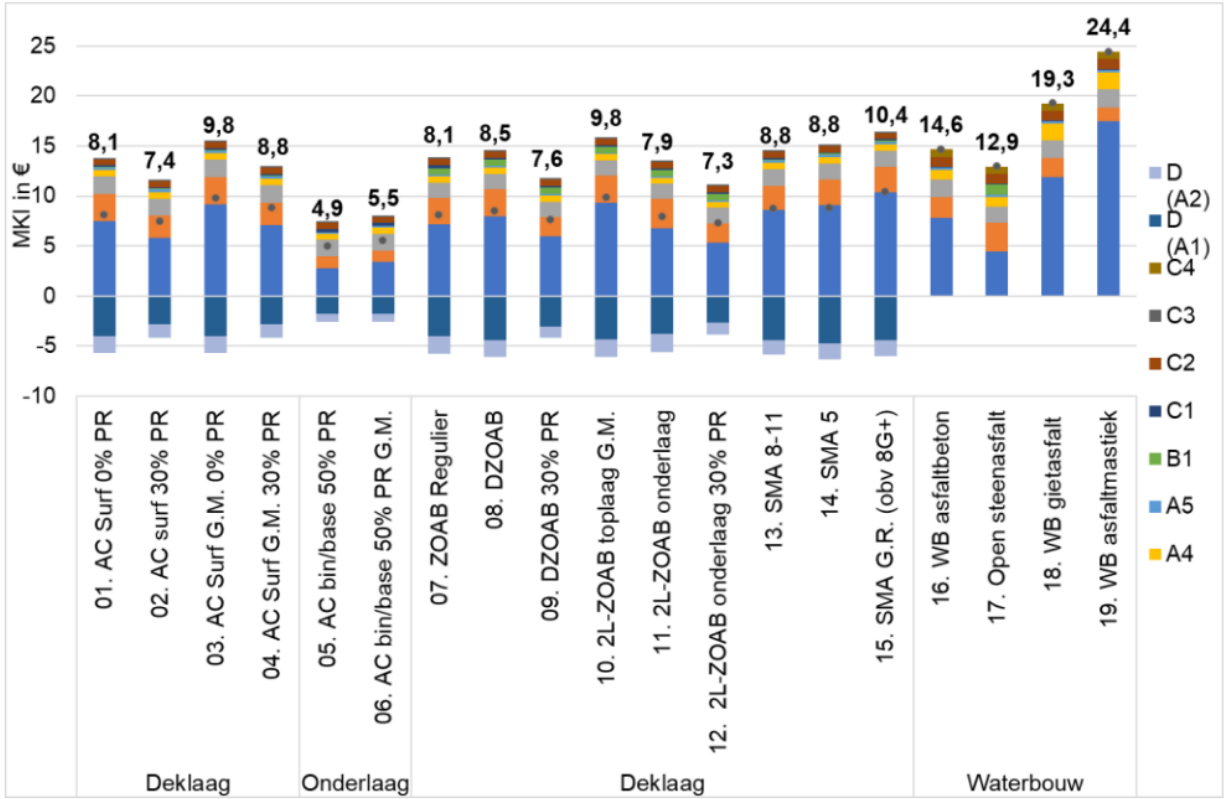
Contribution analysis life cycle stages



Resources (A1),
+
Transportation (A2)
+
Production (A3)
=
75-88%
of total impact

Source: Schwarz, A, et.al. (2020), LCA Achtergrondrapport voor brancherepresentatieve Nederlandse asfaltmengsels 2020, TNO

Savings of primary raw materials



Closed loop recycling is beneficial (30-50%

Source: Schwarz, A, et.al. (2020), LCA Achtergrondrapport voor brancherepresentatieve Nederlandse asfaltmengsels 2020, TNO

Circularity = sustainable?

Case study 1
Polycyclic Aromatic Hydrocarbons

Problem:

1. PAH in road pavements causes environmental risks.
2. Recycling returns PAH to road pavements.

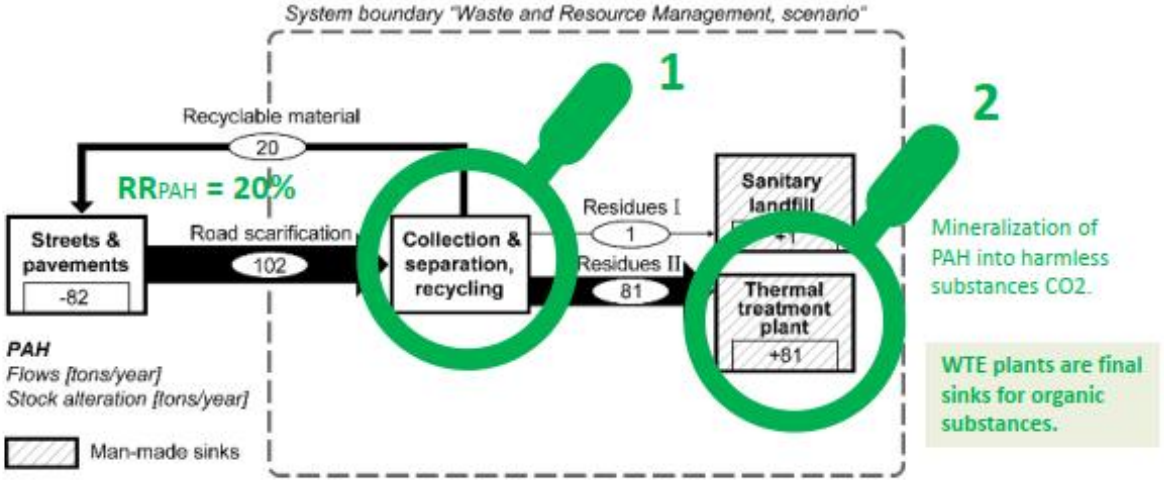
Source: Kral, U. et al (2021). *Sinks are indispensable for a circular economy!* TU Wien, 16th International Conference on Waste Management and Technology, June 27-28, Beijing China

Case study 1
Polycyclic Aromatic Hydrocarbons


http://www.graveperbau.de

Solution:

1. **Removing PAH during recycling.**
2. **Directing PAH to waste incinerators.**



Lessons learnt from LCA

- ✓ Upstream processes of asphalt production dominate total environmental load
- ✓ Recycling is beneficial as long as toxic elements are being removed and sent to final waste sinks
- ✓ Transportation could offset benefits of recycling
- ✓ Other key parameters include energy use during production

Objectives of procurement

- ✓ Higher rates of reclaimed asphalt (RA) replacing asphalt binder and aggregates
- ✓ Production in proximity of the construction site
- ✓ Lower temperature mixes (warm mix asphalt, etc.)
- ➢ *Durability (risks include insufficient adhesion (WMA's) & lower mixing efficiency (RAP) leading to poor rutting resistence and premature distresses of asphalt pavement)*
- ➢ *Bids should be comparable using objective metrics*

How did we achieve these objectives?

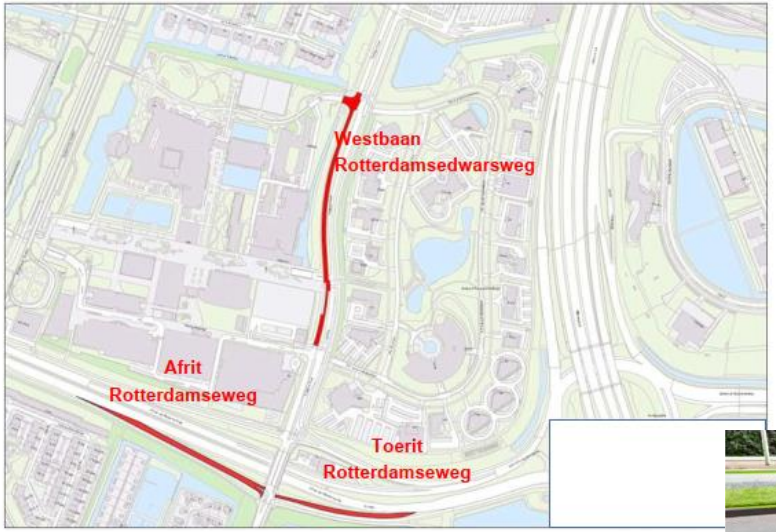
- The ECI as a single indicator for total environmental performance
- Technical evaluation method of structural pavement life, material characteristics etc. according to guidelines of the Dutch Technology Platform for Transport, Infrastructure and Public Space (CROW)
- In case of prescriptive asphalt types and amounts (lot 1) Rotterdam sets a treshold on the ECI/ton (Dutch reference values)
- Within lot 2, contracters are allowed to use innovative asphalt construction methods including layer design ashalt mixes maximising opportunities for innovative bids. Scope of the LCA is an LCA/project.

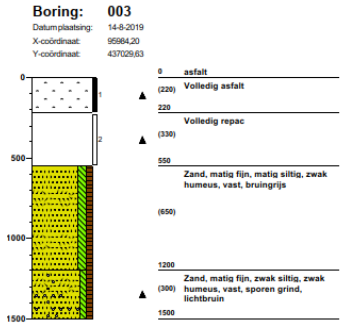
- Lot 2 requires more effort in terms of tender evaluation and contract management!

Method

1. Define the scope within the project for which you allow alternative solutions
2. Define technical performance criteria including evaluation method
3. Calculate a reference value of the ECI
4. The contractor receives a discount on the bid price whenever his ECI is lower than the reference value

1. Define the scope





Scope definition include:

- Surface area
- Traffic data
- Samplings (e.g. PAH, asbestos)
- Layer construction details
- Pictures of local situation

2. Technical requirements

- Allow innovative bids

❖ *Find the lowest ECI through material choices and layer design. There are multiple solutions.*

- Ask for a declaration of performance

❖ *EN 13108 or comparable*

- Use formal calculation rules both for the construction and environmental performance

❖ *Construction: Harmonized calculation rules for technical performance*

❖ *Environmental: Product Category Rules for Asphalt LCA's*

3. Calculate reference value and compare outcomes

KESSEL

Projectonderdeel Rotonde Blijdorplaan

Oppervlakte (m2) 1000

	Soort mengsel	Dikte (mm)	Massa (ton)	MKI inschrijving per levenscyclusfase					
	Inschrijving	Inschrijving	Inschrijving	A1-A3	A4	A5	B1	C1-C2	Kessel
Bovenbouw									
Asfaltconstructie									
deklaag	SMA-NL 11 B PMB kl3steen	35	87,50	612,50	48,13	21,88	5,25	26,25	0,71
kleeflaag	kleeflaagemulsie	0,3kg/m2	0,30	13,38	0,36	3,02	0,00	0,01	0,02
tussenlaag	AC 22 bind TL-C PMB	70	175,00	581,00	96,25	24,50	0,00	96,25	0,80
kleeflaag	kleeflaagemulsie	0,3kg/m2	0,30	13,38	0,36	3,02	0,00	0,01	0,02
onderlaag	AC 16 base 40/60 99% PR	70	175,00	187,25	29,75	24,50	0,00	96,25	0,34
Fundering	menggranulaat	0	0,00						
TOTAAL MKI			438,10	1.407,51	174,85	76,91	5,25	218,76	1.883,28
per m2				1,41	0,17	0,08	0,01	0,22	

BALLAST

Projectonderdeel Rotonde Blijdorplaan

Oppervlakte (m2) 702

	Soort mengsel	Dikte (mm)	Massa (ton)	MKI inschrijving per levenscyclusfase					
	Inschrijving	Inschrijving	Inschrijving	A1-A3	A4	A5	B1	C1-C2	Ballast
Bovenbouw									
Asfaltconstructie									
deklaag	RSMA 8B 70%PR	30	48	183,33	37,72	11,94	2,86	43,92	0,40
kleeflaag	bitumen emulsie 0,3kg/m2	0	0,21	11,17	0,25	2,12	0	0,01	0,02
tussenlaag	AC 16 ECO Bind	50	82	137,75	65,16	11,55	0	96,51	0,44
kleeflaag	bitumen emulsie 0,3kg/m2	0	0,21	11,17	0,25	2,12	0	0,01	0,02
onderlaag									0,00
Fundering									
Onderbouw			130,65	343,43	103,39	27,72	2,86	140,44	
TOTAAL MKI				0,489213	0,147279	0,039483	0,004081	0,200062	617,84

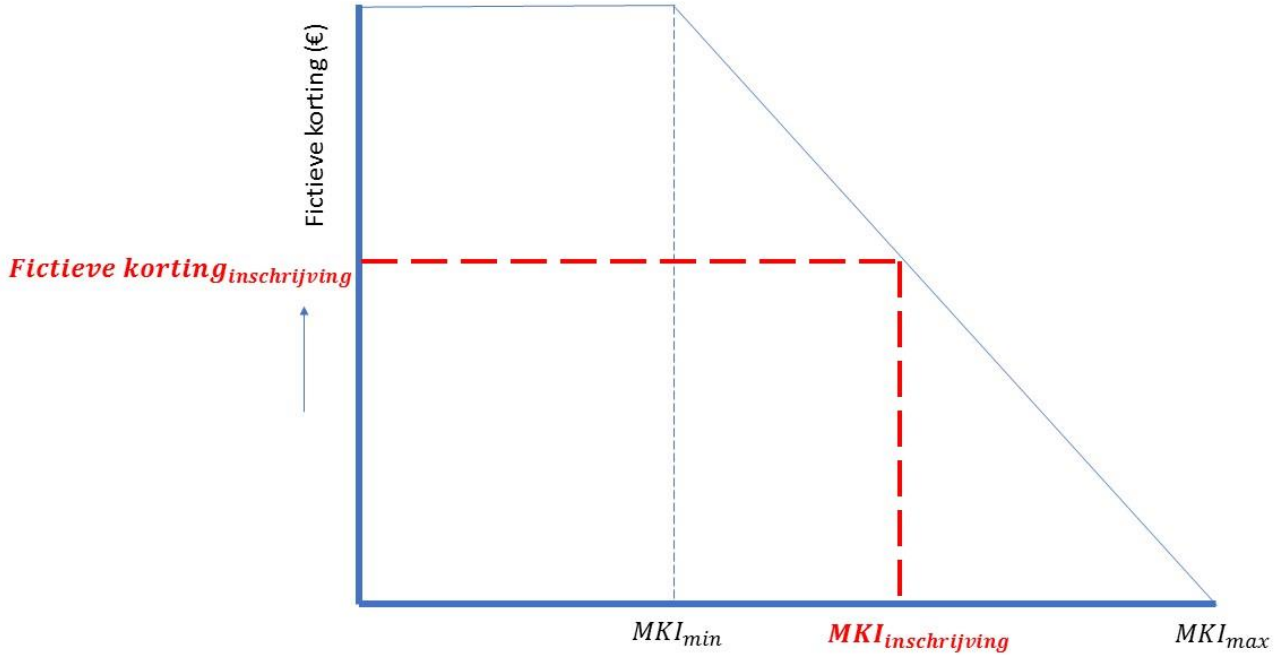
VERSLUYS

Projectonderdeel Rotonde Blijdorplaan

Oppervlakte (m2) 745

	Soort mengsel	Dikte (mm)	Massa (ton)	MKI inschrijving per levenscyclusfase					
	Inschrijving	Inschrijving	Inschrijving	A1-A3	A4	A5	B1	C1-C2	
Bovenbouw									
Asfaltconstructie									
deklaag	SMA-NL 11 B PMB	35	65	365,7019	16,29688	16,29688	29,98625	24,77125	
kleeflaag	kleeflaag		0,2235	2,0115	2,0115	0	0	0	
tussenlaag	AC 22 bind TL-C PMB 50% PR	70	130	521,5	32,59375	32,59375	0	49,5425	
kleeflaag	kleeflaag		0,2235	2,0115	2,0115	0	0	0	
onderlaag	AC 22 base OL-C 70% PR	70	130,375	340,2788	32,59375	32,59375	0	49,5425	
Fundering		let op m2	745			163,9			
TOTAAL MKI				1231,504	85,50738	245,3844	29,98625	123,8563	1716,23788

4. Calculate the winning bid



$$Fictieve\ korting\ inschrijving = \frac{(MKI_{max} - MKI_{insc\ hrijving})}{(MKI_{max} - MKI_{min})} \times maximale\ fictieve\ korting$$

Market response

- 9 contractors (Lot 1), 4 contractors (Lot 2)
- ECI reductions up to 50% compared to reference value
- Up to 70% PR
- Usage of higher PR’s and dematerialisation can go together