

1. Circular Design and Procurement in Infrastructure

- **Machiel Crielaard**, Landscape Architect, Rijkswaterstaat Netherlands

2. Circular Buildings in practise

- **Alastair Burns**, Innovation Development Manager, Royal BAM

3. Circular Procurement Dutch National Library Netherlands

- **Yvette Watson**, Tender manager, Phi factory





Circular Design & Procurement

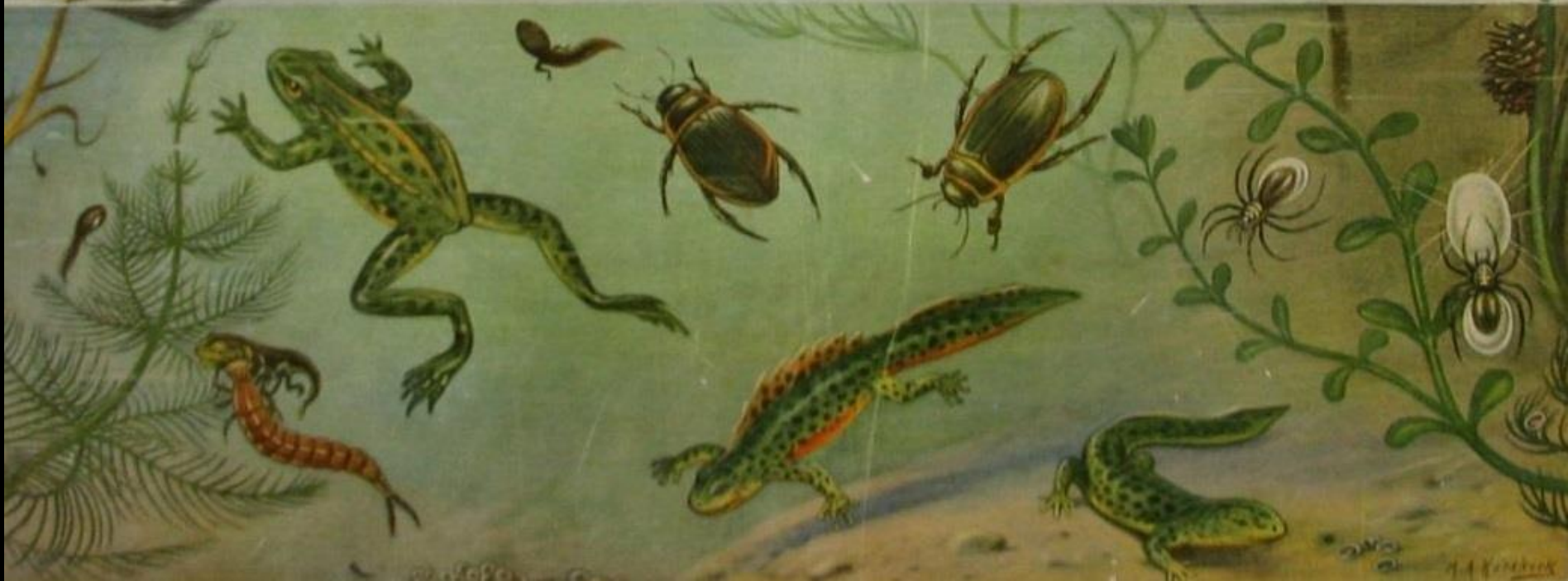


Machiel Crielaard

Ministry of Infrastructure and Water Management
DG Rijkswaterstaat

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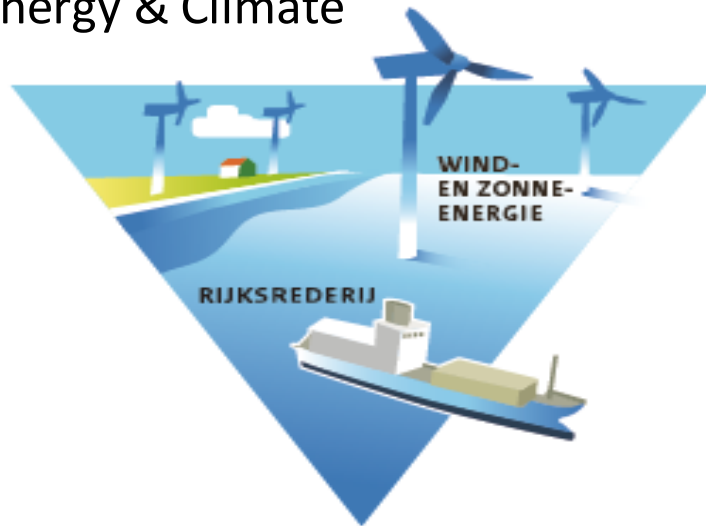






Focus areas sustainability Rijkswaterstaat

Energy & Climate



“To make Paris come true”

- 2020: -20% CO2
- 2030: Energy neutral
- 2030: Climate neutral

Circular Economy



“No waste”

- 2030: RWS works circular
- 2030: -50% primary or raw materials
- 2050: No waste

Sustainable area development



“Sustainable area development”

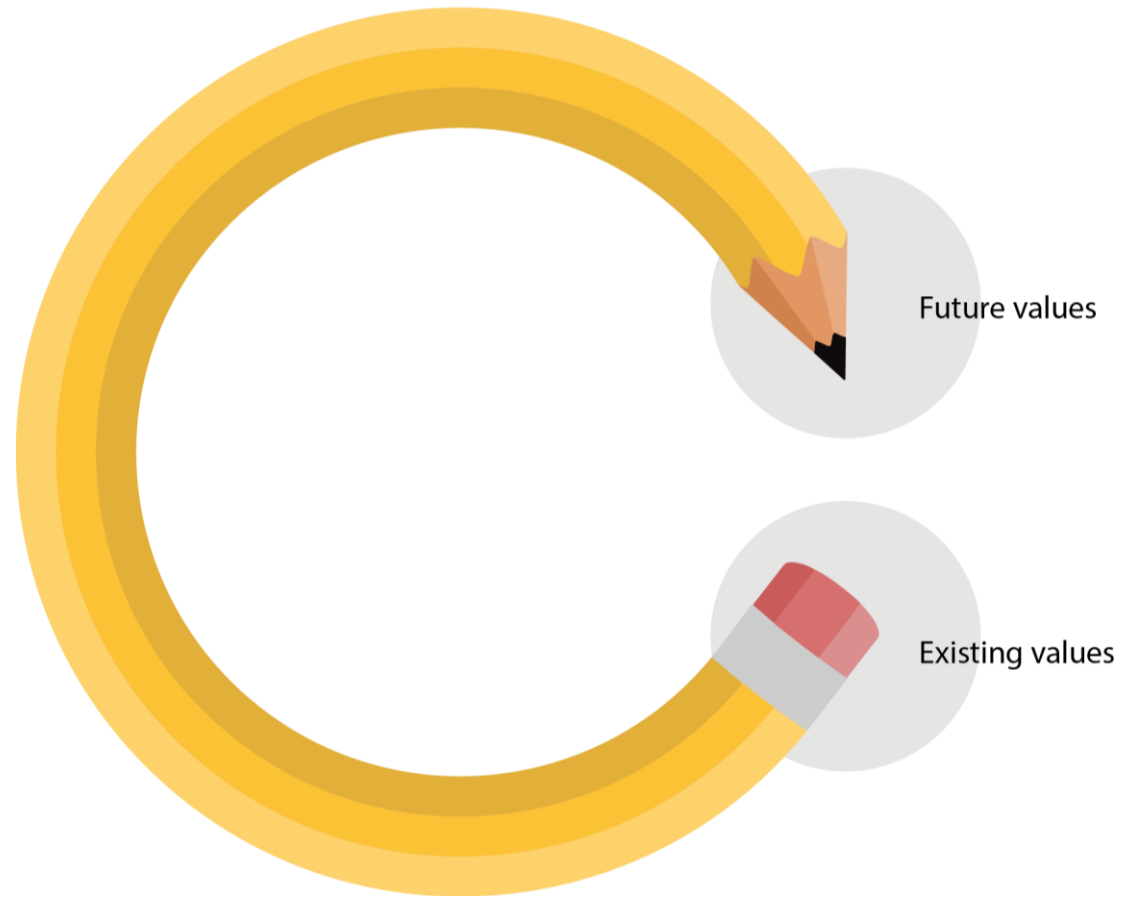
- Think from local qualities and demand
- Multiple use
- Together with stakeholders

**'Circular procurement is not only
about procurement'**

Integral Collaboration with Value Engineering



Retain and Create Value



Circularity in Design – 3 categories

Prevention

Rethink the need

Find non material solutions

Retain Value

Life time extension

Reuse existing materials

Supply-driven design

Create Value

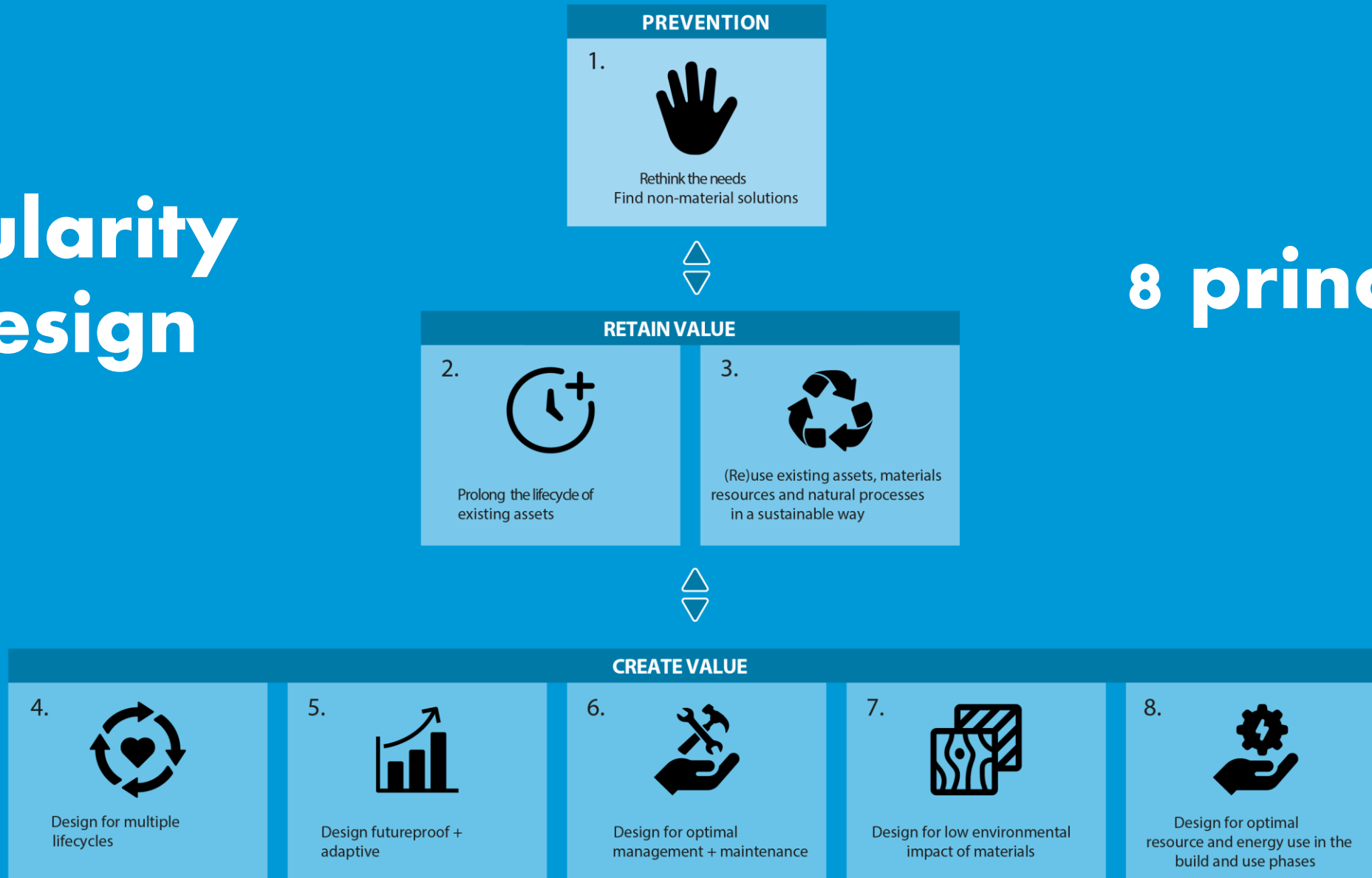
Design for

- ... multiple life cycles
- ... futureproof adaptable
- ... optimal management
- ... low environmental impact
- ... optimal energy & resource use in use phase

The application of circular design principles for the built environment

Circularity In Design

8 principles



1 Prevention: find non-material solutions

Barrier



No Barrier



2 Retain value: lifetime extension


Extending the lifetime of asphalt



3 Retain value: reuse existing assets



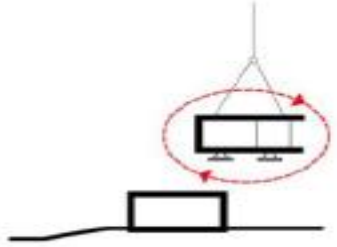


An aerial photograph of a coastal region, likely a delta or estuary, showing a complex network of waterways and agricultural fields. A prominent red and white striped boundary line runs along the top and right edges of the land area. Two specific areas are highlighted in bright green: one is a small rectangular area near the top center, and the other is a long, narrow strip along the bottom right edge. The background is a dark blue, representing the open sea.

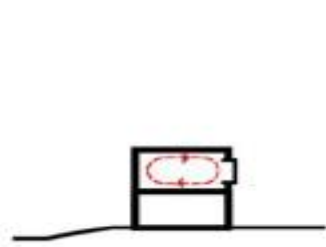
Use natural processes
Ripening dredging residue
to a building material

4 Design for multiple life cycles

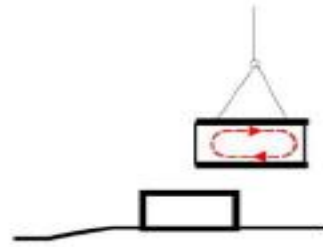
Operating building for lock near Kampen



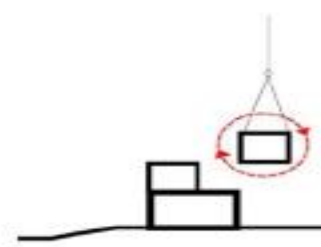
Re-use as a
movable
building in
another
function



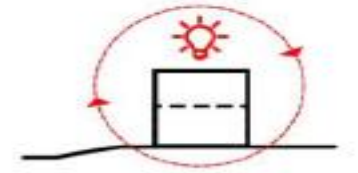
Re-use as a
building on-
site



Re-useable
as a
operating
building



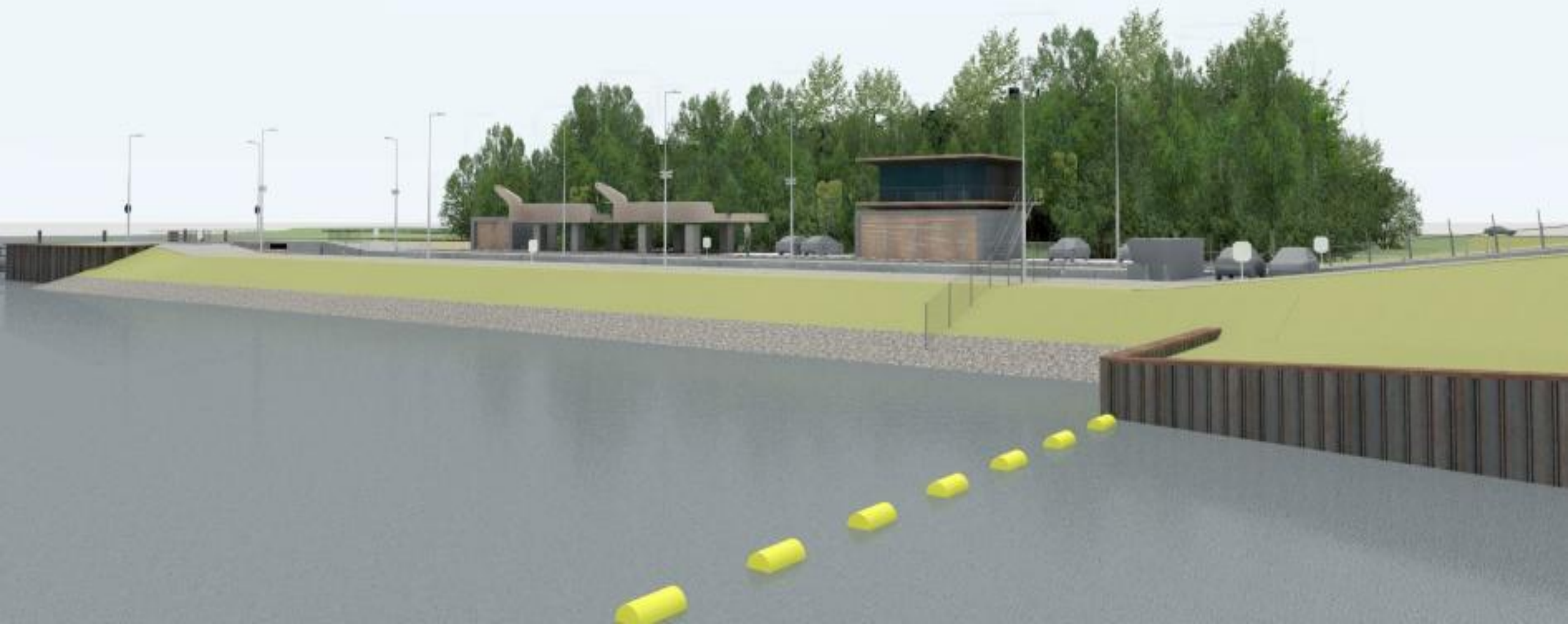
Re-use of
components



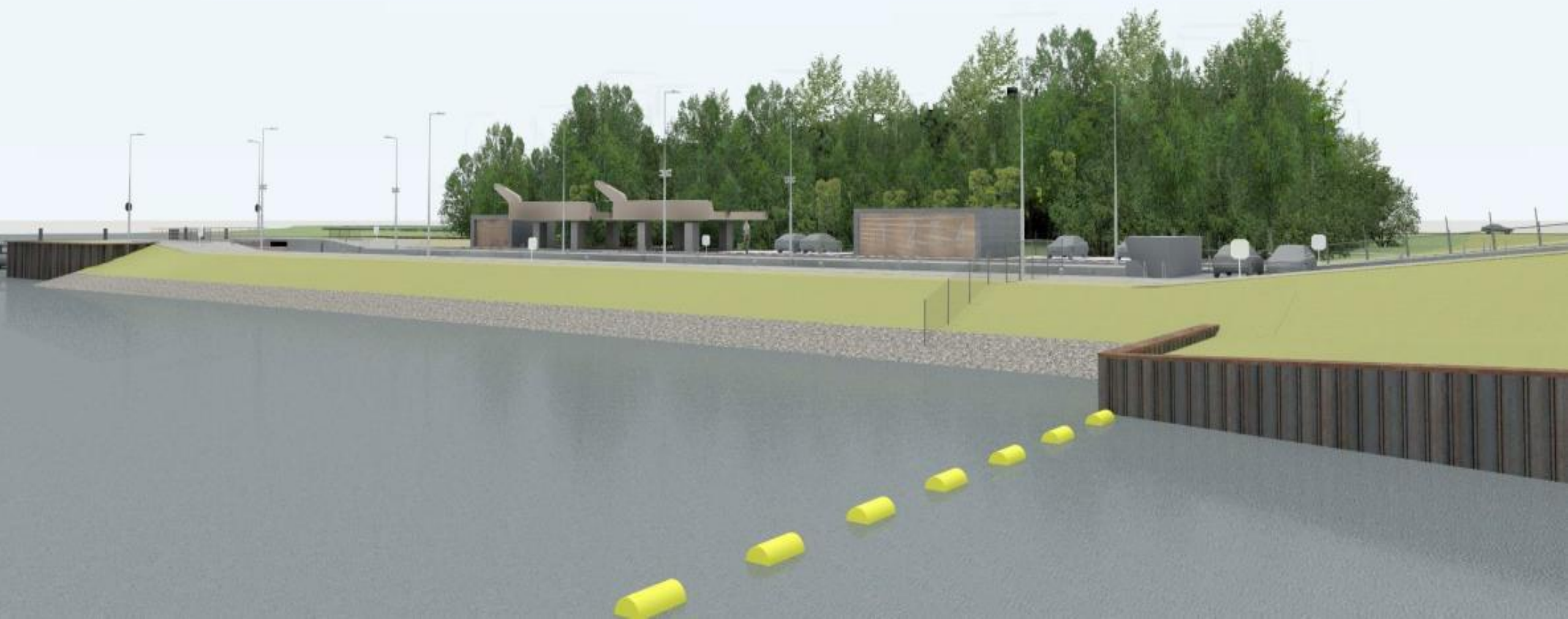
Re-cyclable
building

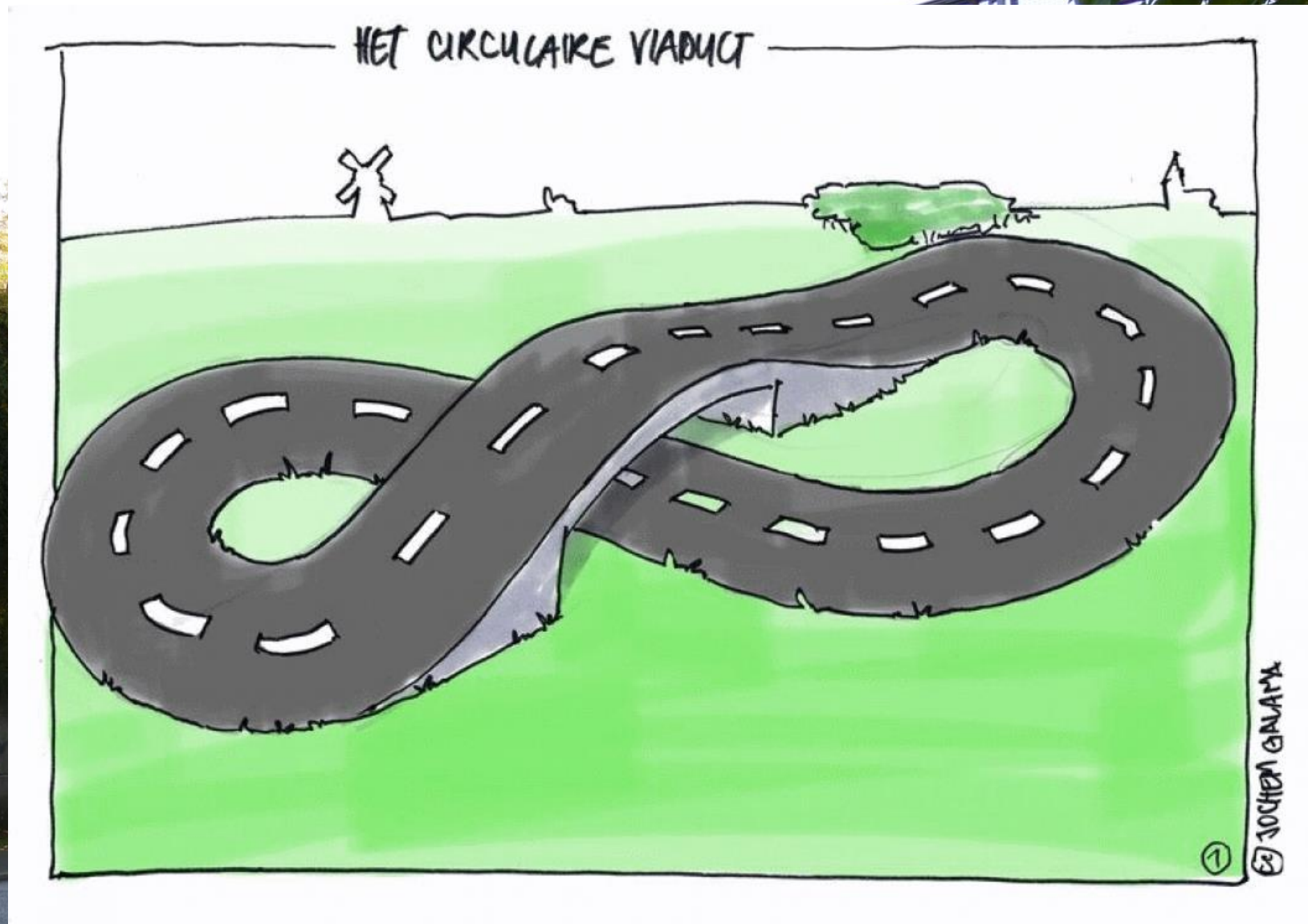


Now



> 5-10 Years





Living lab circular bridge



5. Design future-proof and adaptable National highway A4



6. Design for optimal management and maintenance

Designing the joints...



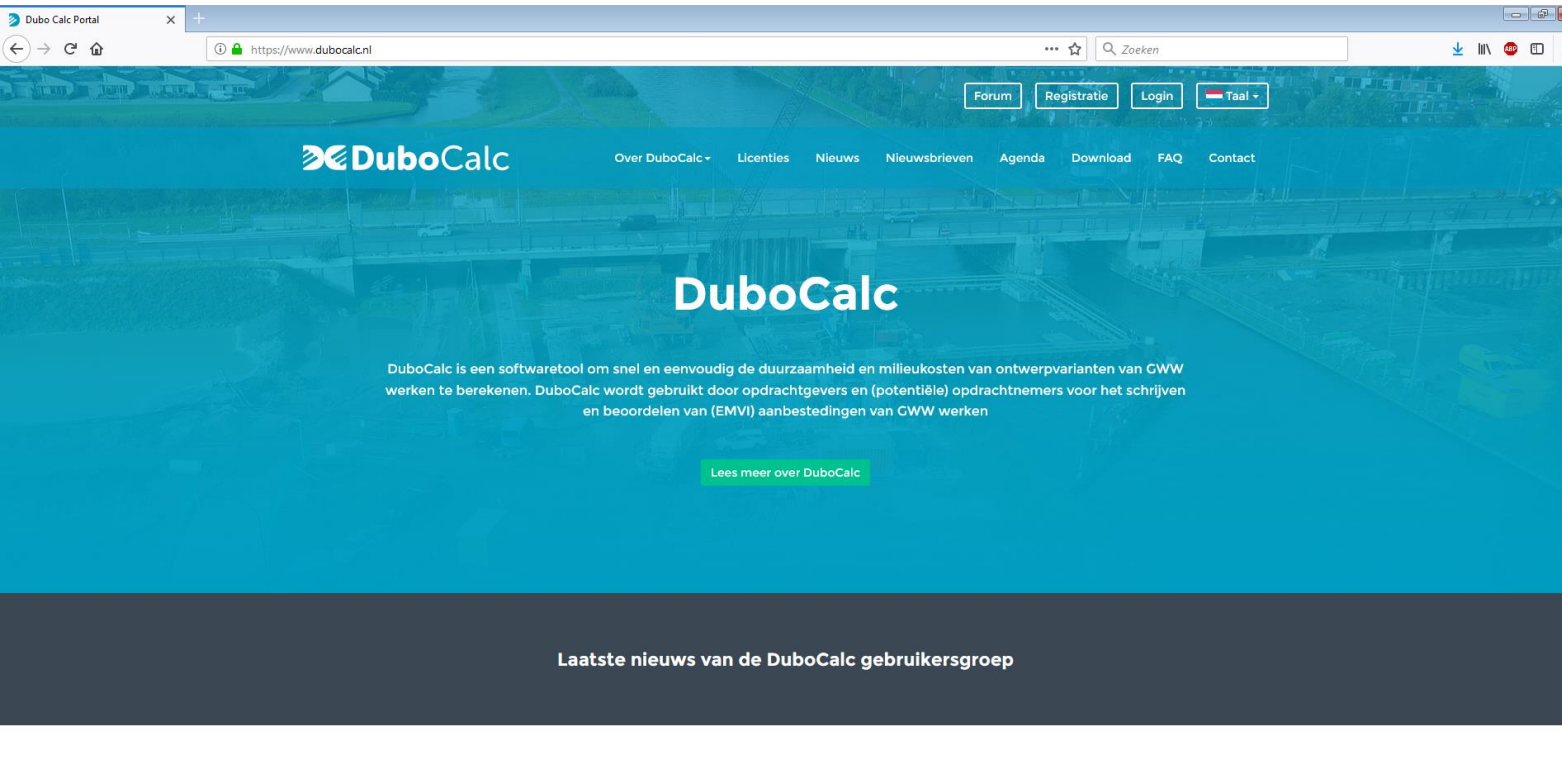
7. Design for low environmental impact of materials



Junction Nijmegen

Using less material, combining functions, better functionality

Life cycle assessment



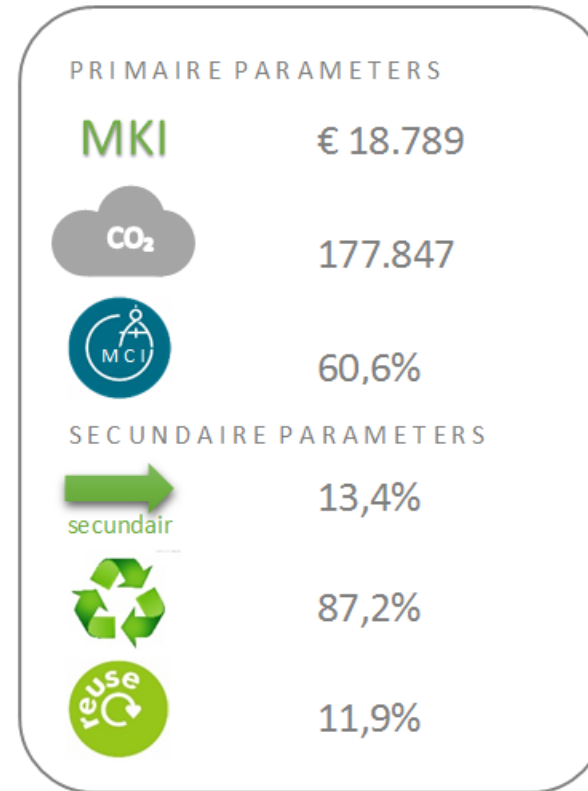
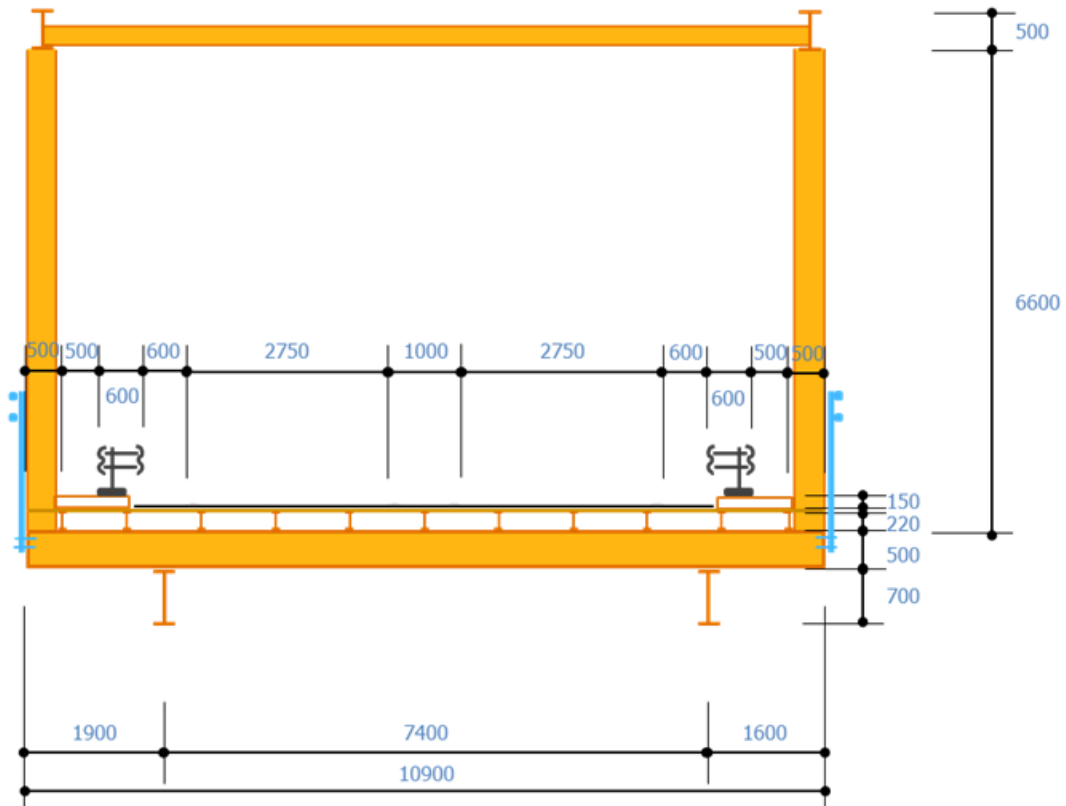
- National Environmental Database (EN15804)
- DuboCalc as supporting tool for procurement
- Rewarding contractors with meat criteria
- Certifying of contractors CO2 reduction in the supply chain



Indicators Circular building?

4.3.1 Variant B: Stalen vakwerkbrug

Variant B: Stalen vakwerkbrug



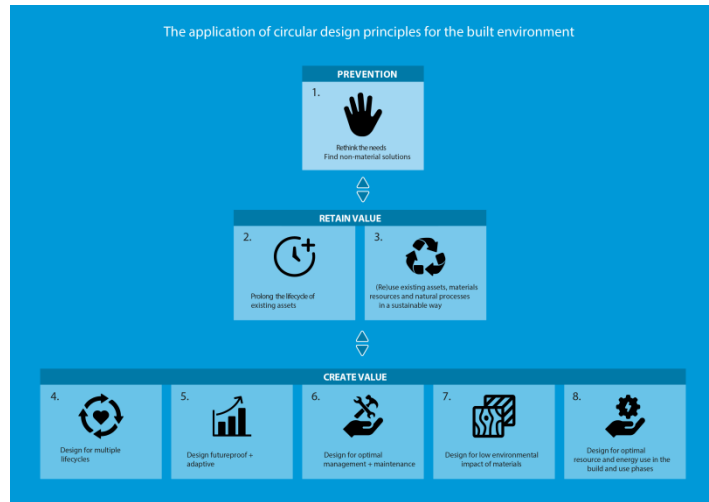
- LCA
- CO2
- Material Circularity Indicator
- Use of secondary materials
- Recyclability
- Re-usability

Figuur 5

Integral collaboration in planning (Value Engineering)

+

C-Design principles

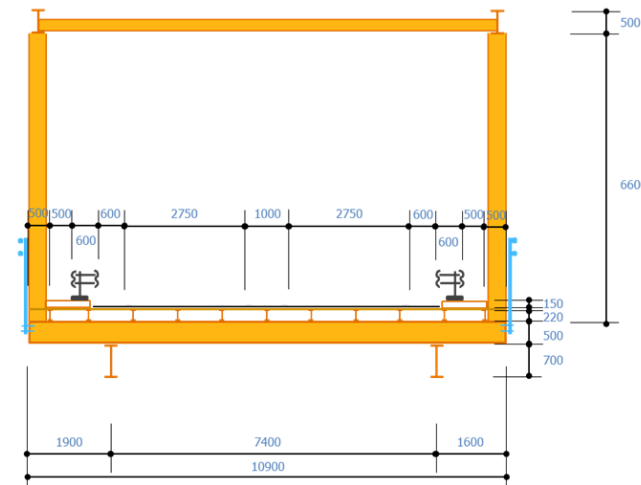


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C-Assesment

4.3.1 Variant B: Stalen vakwerkbrug

Variant B: Stalen vakwerkbrug



PRIMAIRE PARAMETERS	
MKI	€ 18.789
CO ₂	177.847
MCI	60,6%
SECUNDAIRE PARAMETERS	
secundair	13,4%
recycle	87,2%
re-use	11,9%

Figuur 5

=

Input for circular procurement

Summary, what's in it?

- Every project has unique design opportunities for Circularity
- Multi-life cycle thinking, planning-design-construction-maintenance-deconstruction
- The design principles help in the planning process
- The design principles can be used to challenge contractors
 - Planning, Engineering, Construction
- Design is needed together with life cycle assessment to find a way to circular procurement.
 - Functional criteria, MEAT-criteria

Office Terneuzen



- Regional office 15 years ago build as a circular concept
- Urban mining: materials re-use at youth clinic



Construction Third Chamber Beatrix Locks



Pilot with material passport



Visionary construction **circular economy**

Alastair Burns, Nitesh Magdani and Sander Holm
Circular Building Platform

BAM

Case – ‘CIRCL’ - ABN Amro Pavilion Amsterdam





Psssst.....

CIRCL started as a 'traditional project' and through shared ambitions and some free thinking, went 'full circle'.

We all shared what we wanted to get out of the project, we trusted each other and guarded each other's goals.

Triangle: Quality, Re-usability, Cost.

Innovations CIRCL – Renewable materials



- Wood CONSTRUCTION spruce and local larch
- Glass facade without sun protection coating, but foil
- No coating on the basement floor, but polishing
- Uncoated steel and aluminum (for example lighting fixtures)
- **The more you treat materials, the less re-usable they become**
- **Materials have their own 'maintenance story'**



Innovations CIRCL – Efficient material use



- Prefabrication to prevent construction waste
 - Steel to reduce wood construction
 - Sand and old terrace tiles for noise reduction
 - 'Green' concrete cellar
-
- **Created headspace to think creatively about solutions.**

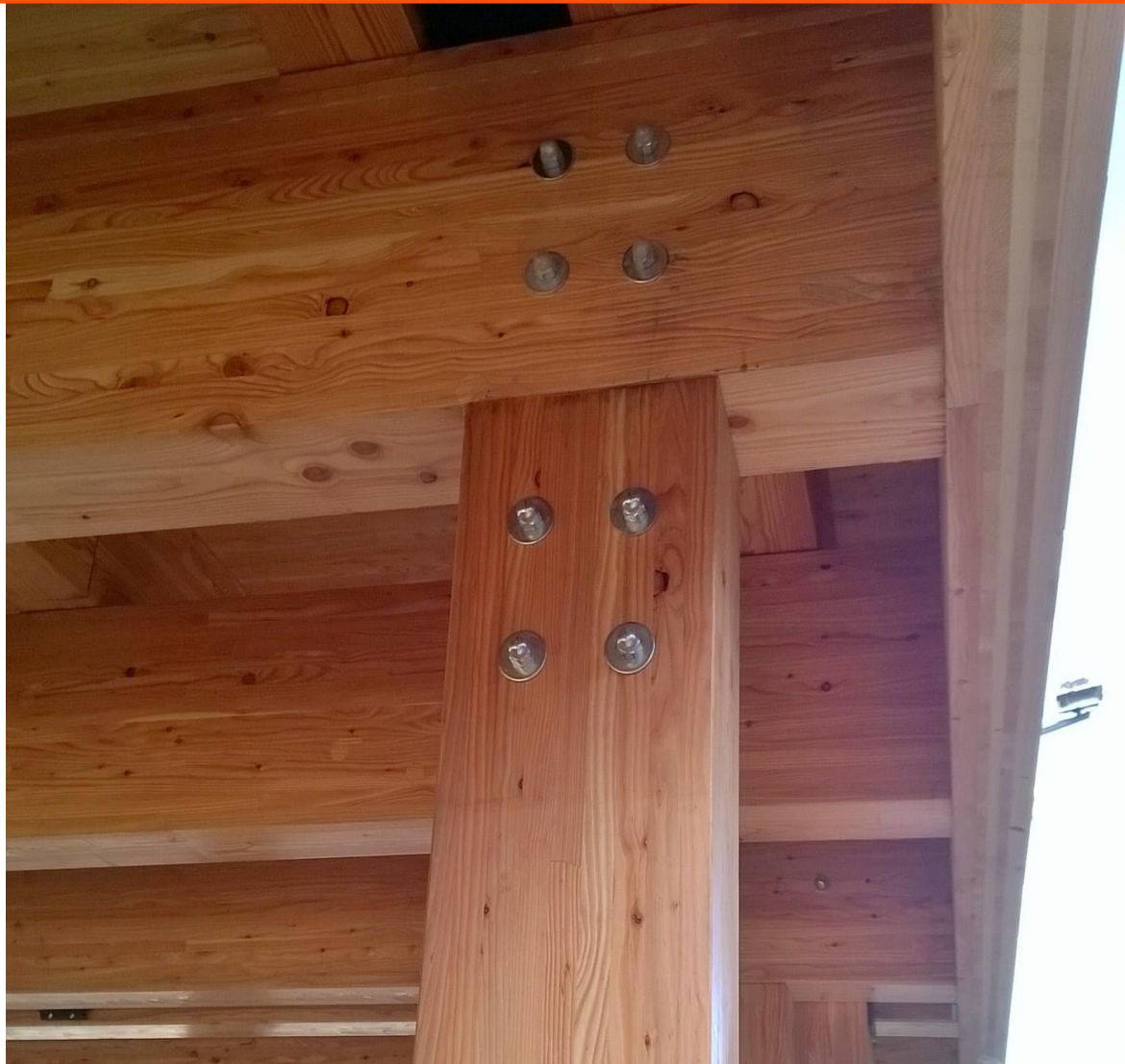


Innovations CIRCL – REmountable



- Whole elements
- Dry connections
- Avoid finishings and coatings

- **Products are more complex than materials, but their life cycle need not be limited to one installation.**
- **Encourage the mindset to ‘Assemble everything’, ‘Make Nothing’.**



Innovations CIRCL – Greening

- Vertical garden instead of vertical pavement
 - Roof garden as an extra public green area
 - Buffering water on the roof for toilet flush and green
-
- **Surprise yourself**

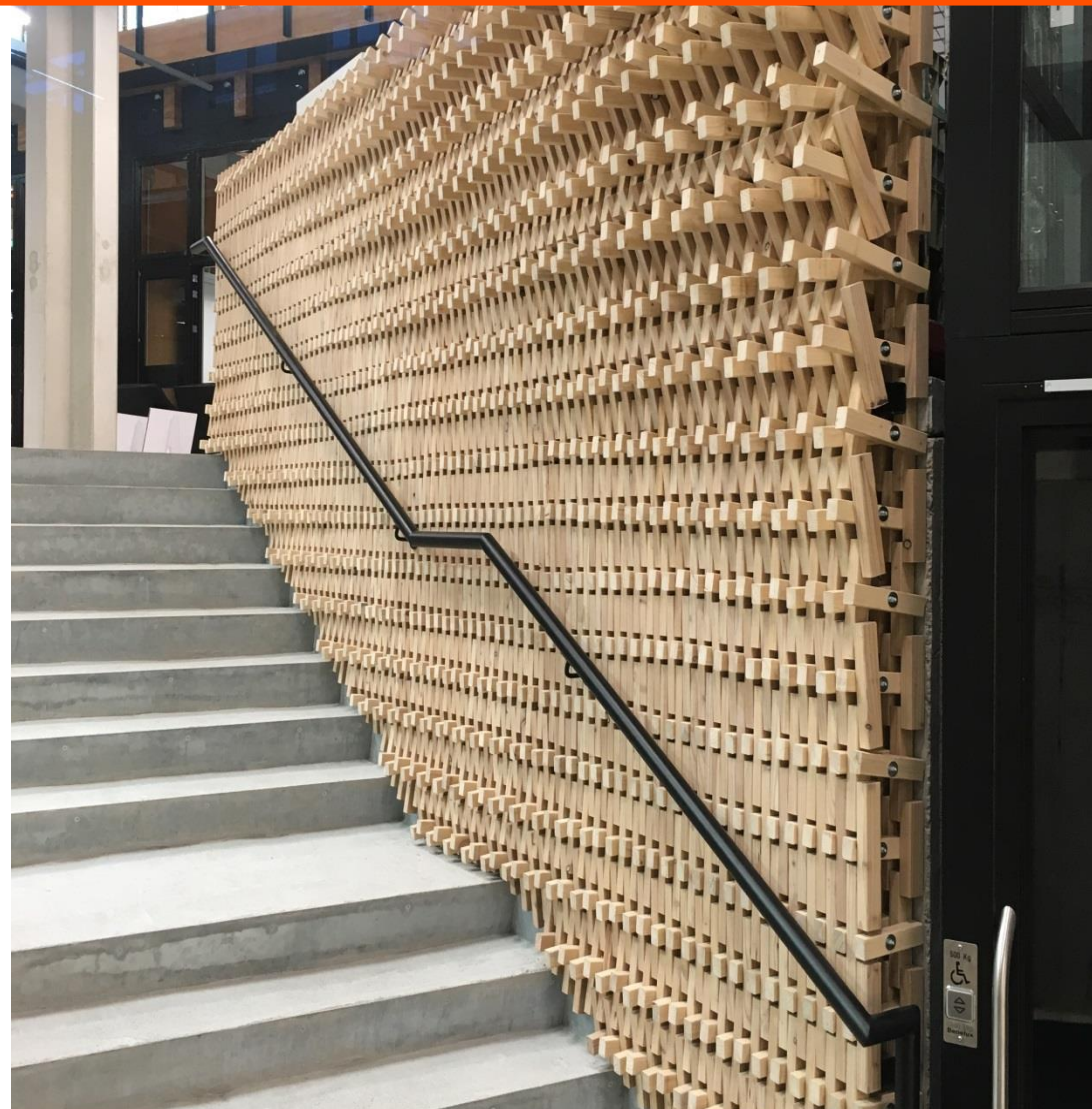


Innovations CIRCL – Reuse old material



- Frames and doors from another building (urban mining)
- Handrail, BSH, cameras from another building
- Aluminum 100% recycled
- Acoustic ceiling from old jeans
- 3D 'printed' fencing from residual wood construction
- Reused parquet floor
- concrete tiles via Marktplaats
- Reuse cabling

- **Form valuable relationships with your suppliers.**



Innovations CIRCL – All electric



- PV panels on roof and facade
- DC whole building
- USB-C connector
- Luminaires on DC voltage
- Hand-operated turnstile
- Heat and cooling via reversible WP with BWW vertical and horizontal -> PCM in the floor
- Use residual heat parking garage



'Building the present, creating the future'

To have a net positive impact on climate change, resources and people by 2050



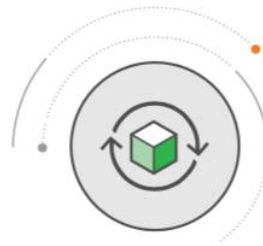
Climate positive



Net positive
climate change impact



Resource positive



Net positive material
resource use



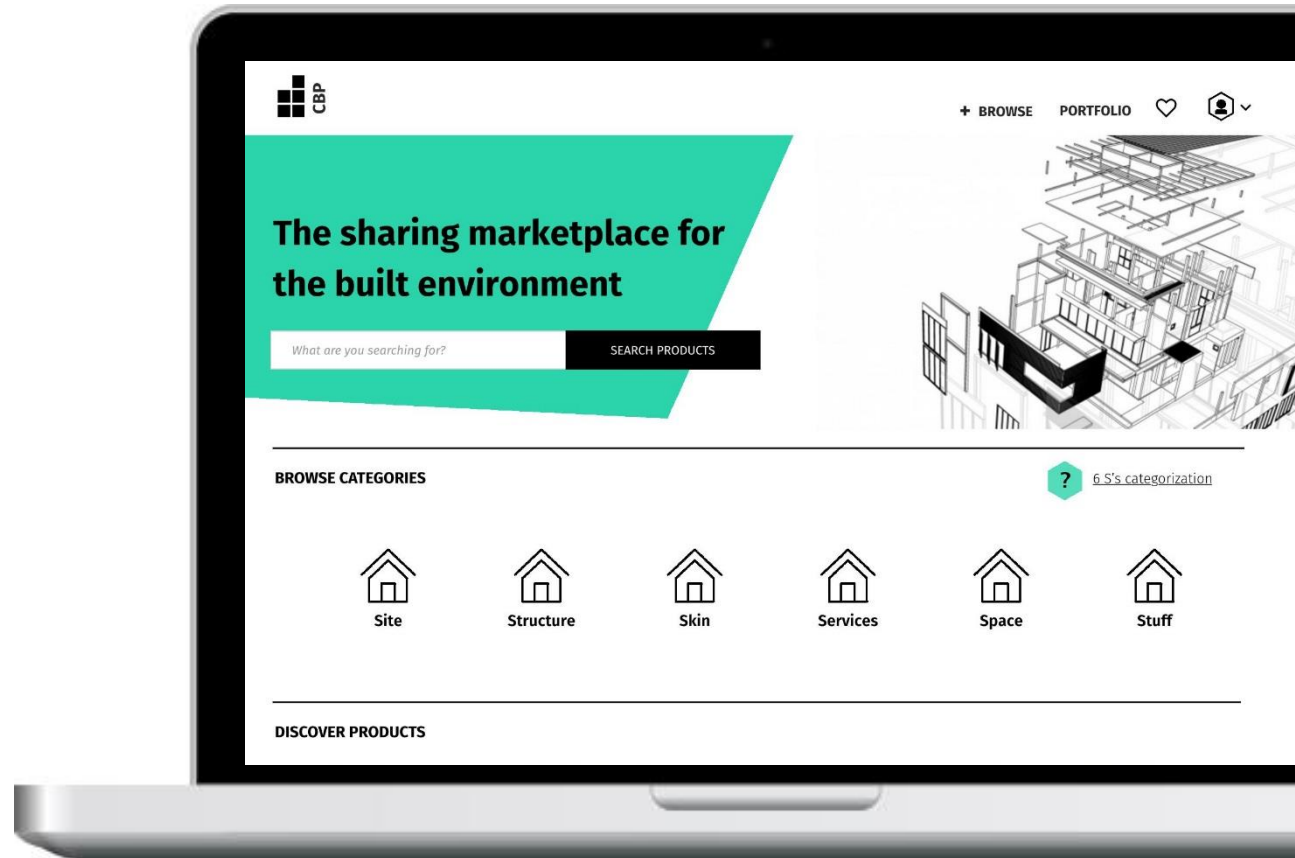
People positive



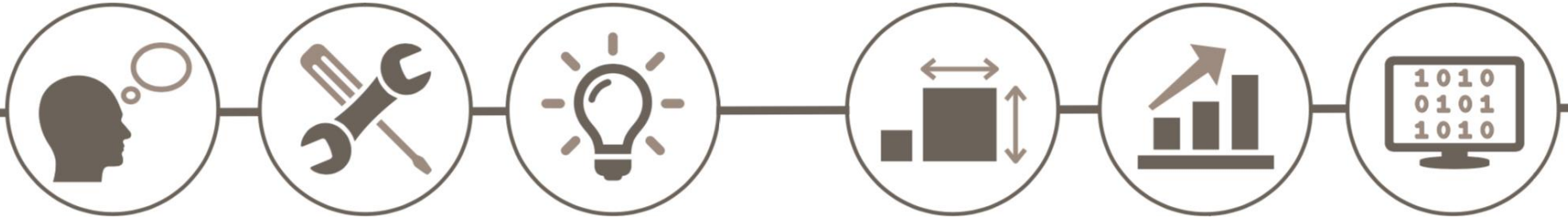
Net positive impact on
local communities

Circular Building Platform

The open, online, B2B platform for all stakeholders in construction to enable reuse



‘Making 100% reuse reality’



- Long term thinking is required
 - Design for subsequent uses
 - Collaboration
 - Flexibility vs durability
 - Innovation
 - New business models
 - Management of information

As much as you want to, you can't please everybody, all the time

Conflict can be good

As long as you are working together

As long as we keep moving forwards

Thank you



Circular Procurement in Construction

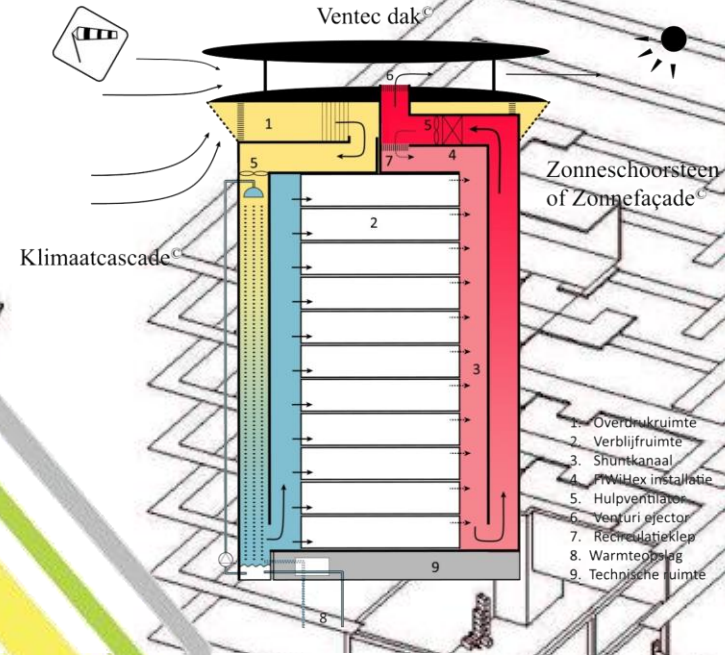
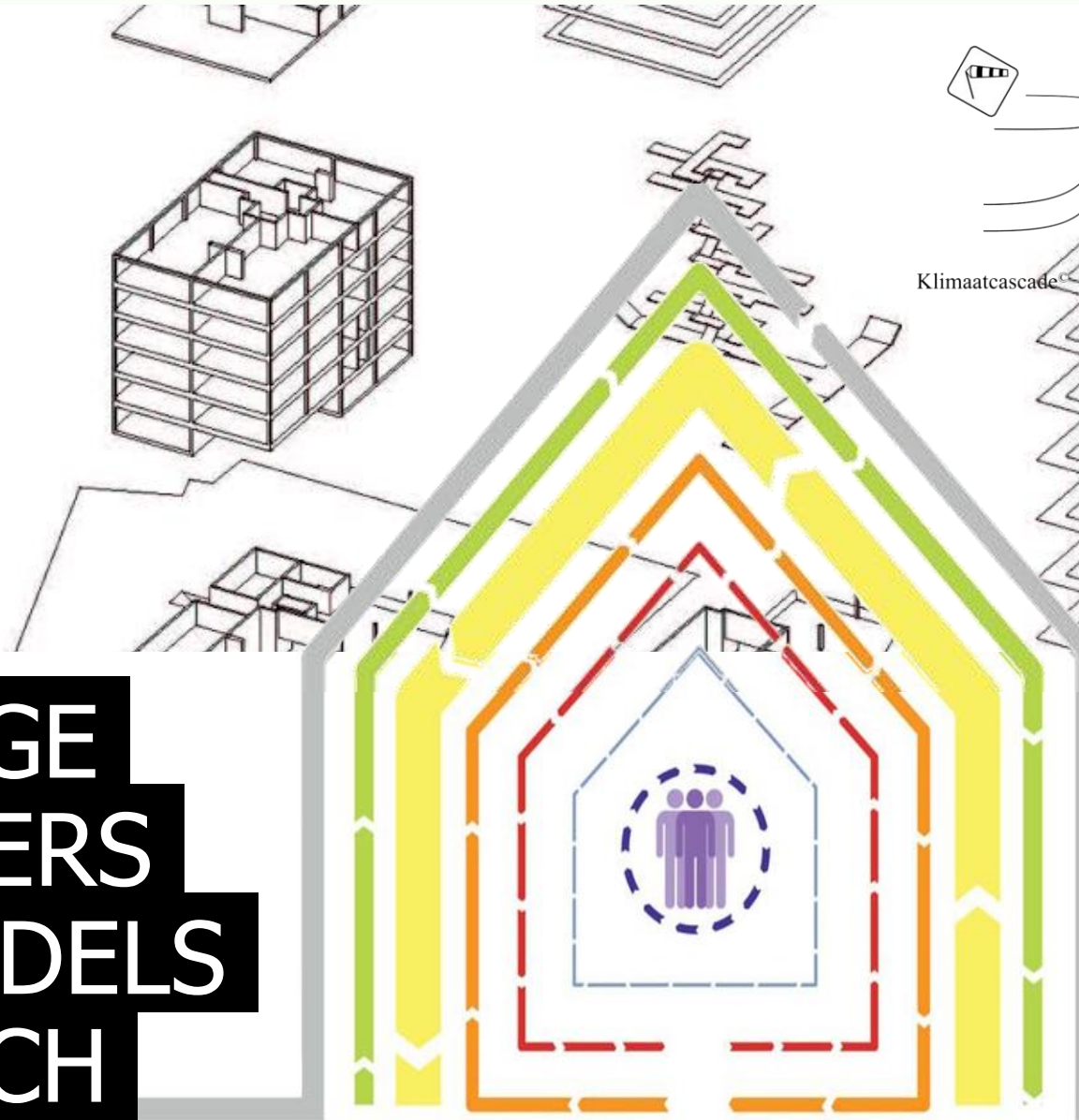
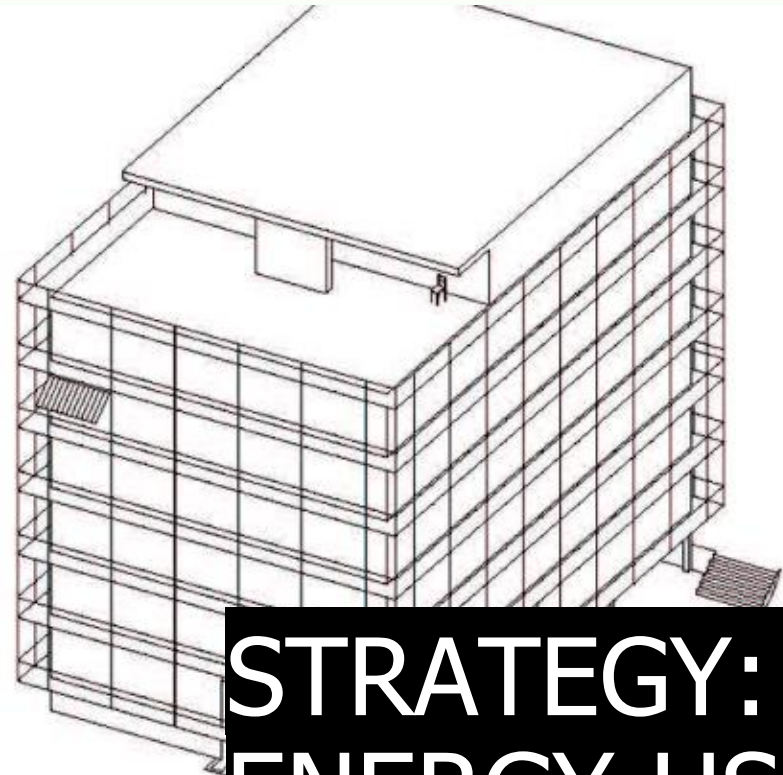
Ambition and approach of the Dutch National Library

**AMBITIONS:
MEANING
FLEXIBLE
ENERGY NEUTRAL
CIRCULAR**





**APPROACH:
PROCUREMENT AND
RESPONSABLE
COMMISSIONING**



- 1. Overdrukruimte
- 2. Verblijfruimte
- 3. Shuntkanaal
- 4. PVWitex installatie
- 5. Hulpventilator
- 6. Venturi-ejector
- 7. Recirculatieklep
- 8. Warmteopslag
- 9. Technische ruimte

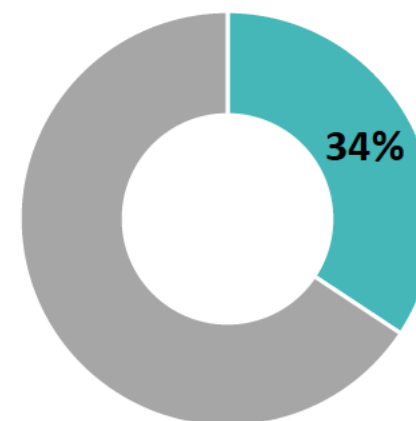
**STRATEGY:
ENERGY USAGE
BUILDING LAYERS
BUSINESSMODELS
TCO APPROACH**

INSTRUMENT: BUILDING CIRCULARITY INDEX



Building Circularity Index Voorbeeldwoning		alba concepts.
Elementen	m ³	ECI
Element 1	24,55	0,501
Element 2	47,92	0,095
Element 3	20,11	0,446
Element 4	20,29	0,419
Element 5	4,12	0,451
Element 6	0,62	0,450
Element 7	2,84	0,632
Element 8	1,85	0,361
Element 9	1,09	0,443
Element 10	0,09	0,445
Element 11	0,02	0,200
Element 12	6,83	0,695
Element 13	0,44	0,694
Element 14	0,00	0,881
Element 15	0,35	0,312
Element 16	0,35	0,312
Element 17	0,21	0,656
Element 18	0,62	0,700
Element 19	0,00	0,908
Element 20	0,10	0,280
Element 21	0,21	0,887
BCI =		34%

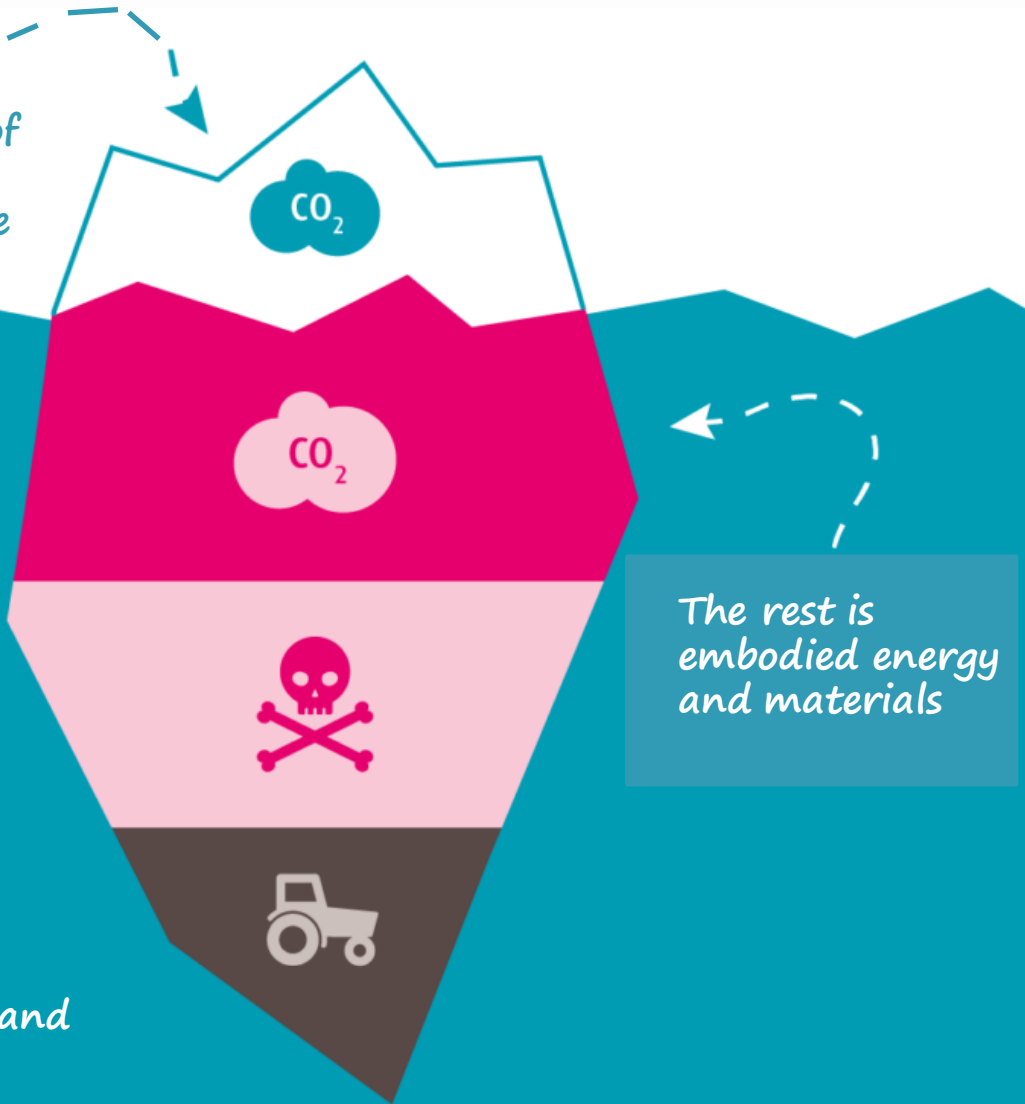
Building Circularity Index -
Voorbeeldwoning



$$BCI = \frac{\sum m^3 * ECI}{Totaal\ volume} = \frac{45,08}{132,6} = 0,34 = 34\%$$

**MATERIALS: ORIGIN, DISPOSAL,
LIFE SPAN & VOLUME
DETACHABILITY: TYPE
CONNECTION & ACCESSIBILITY**

Only one fifth of the impact is related to usage



Extraction, processing, manufacture and delivery

**SCOPE:
CO2 EQUIVALENT
TO MATCH
ENERGY WITH
MATERIALS**



**CREATING
SUPPORT FOR
OUR AMBITIONS**

Conclusions and discussion

1. Procurers become **material traders**
2. Include **CO2 figures for materials** in procurement?
3. We need **a real value** of a building
4. Collaborate and **Just START**
None of us have the answer (alone)

