100 YEARS ANNIVERSARY

INTERNATIONAL UNION OF RAILWAYS

ZERO WASTE RAILWAYS WORKSHOP 1

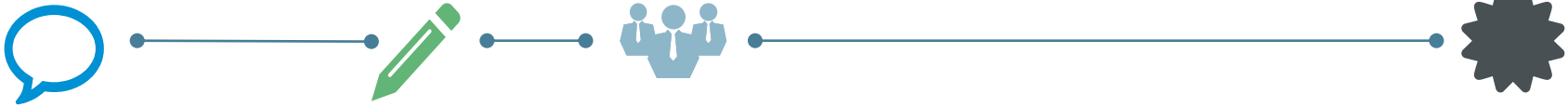
CIRCULAR INFLOWS

AGENDA

12.00	**Networking lunch (60 mins)**
13.00	**Opening of the workshop - Isabelle De Keyzer, Sustainability Advisor (30 mins or less)** **Today's program** **Welcome by the Circular Economy Chairs** Katy Beardsworth, Environmental Strategy Manager, Network Rail Ilse de vos-Van Eekeren, Programme manager Circular Economy, NS Introduction on UIC and its sustainability mission statement, the CE sector and the Sustainable Procurement group
13.30	**Keynote: BIOMIMICRY : Nature-based solutions to rethink rail (60 mins)** Dr Arndt Pechstein, Q&A and discussion for application in railway sector
14.30	**Best Practice sharing – Measuring Circular inflows (60 mins)** • SNCF Material Passports - Bénédicte Gourmandin, SNCF Réseau (10 mins) • Measuring circular inflows and material passports for trains - Ilse de Vos-Van Eekeren, NS (10 mins) • Case Study: Materials Circularity Indicator for Sleepers - Katy Beardsworth, Network Rail (10 mins) • Case Study: Circularity in the automotive industry – Eugenio Sergio Longo, Tata Consultancy Services Europe 10 mins 20 Mins Panel Discussion with Q&A (moderated by Isabelle De Keyzer)
15.30	Break (30 mins)
15.45	**Best Practice sharing – Circular Successes (60 mins)** • Wheel sets – CO2 and Circular Economy benefits, Joris van De Sande, NS 10 mins • Center of Competence for Circular Economy – Fabiano Piccinno, SBB 10 mins • HS2 Circular Economy Strategy – Peter Miller, HS2 10 mins • Rolling stock and circular practices – Marty Thomas, Wabtec 10 mins 20 mins Q&A and Group discussion (moderated by Isabelle De Keyzer)
16.45	Closing (15 mins)

WELCOME & INTRODUCTION

UIC: a long history of serving member railways and facilitating international railway cooperation



1921

Intergovernmental (diplomatic) conference in Portorož, Slovenia (formerly in Italy)

1922

Intergovernmental (diplomatic) conference in Genoa, Italy

October 1922

Constitutive Assembly of UIC (Paris): UIC statutes adopted by 51 railway administrations in 29 countries (Europe, Asia)

2022

200 member railways in 95 countries

100th anniversary

100 YEARS ANNIVERSARY UIC INTERNATIONAL UNION OF RAILWAYS


3
fora
9
platforms
23
sectors
136
working groups
9
special groups
95
countries
200
members
2000
experts

Sustainability Platform @ UIC
Our Vision

A railway that supports a green recovery as the **backbone of sustainable mobility**. Connectivity that contributes to healthy and sustainable lifestyles and economies on every continent – that is zero emissions, resource efficient, a community hub, accessible for all, and is both biodiverse and a good neighbour

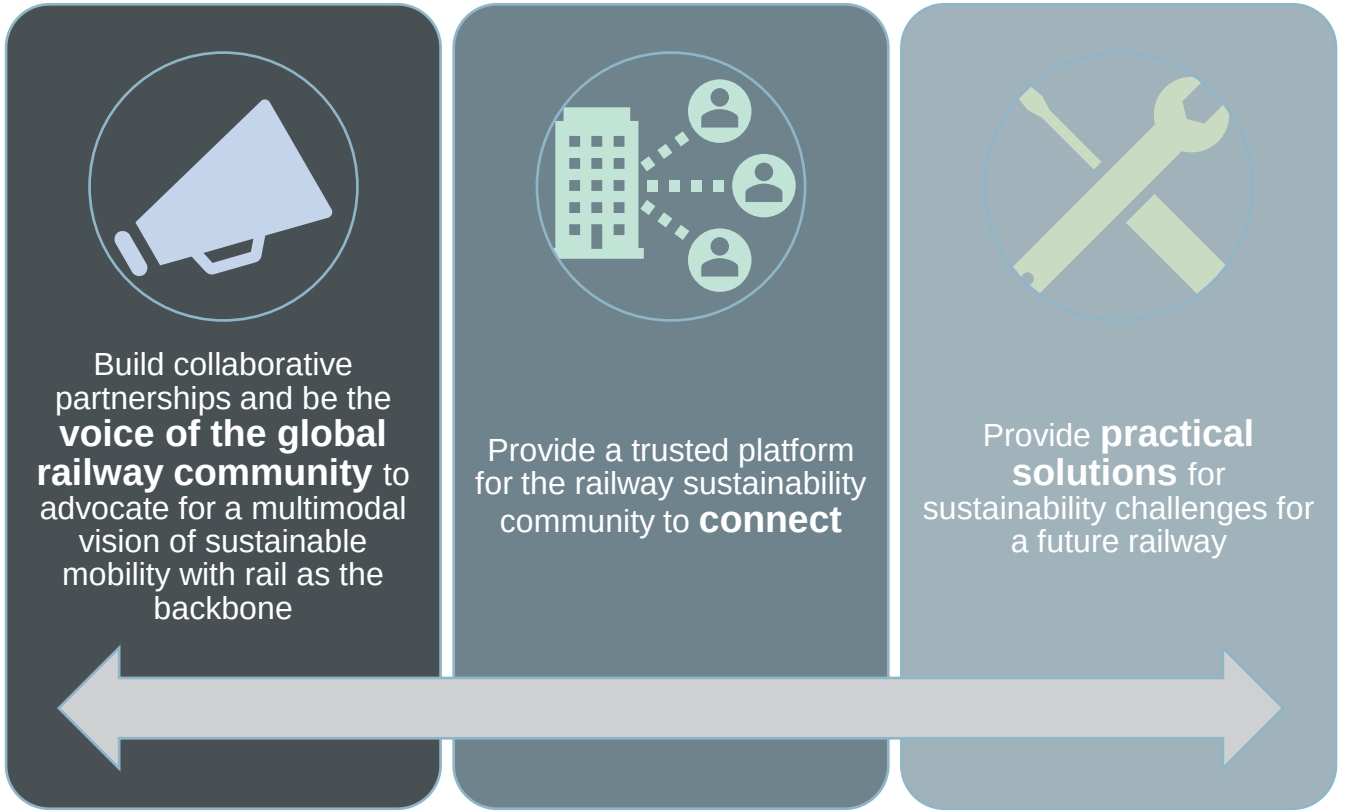
INTERNATIONAL UNION
OF RAILWAYS

SUSTAINABILITY @ UIC

MISSION

TO EMPOWER THE GLOBAL RAILWAY COMMUNITY TO BE A DRIVING FORCE IN A GREEN RECOVERY THROUGH COLLABORATIVE KNOWLEDGE AND ADVOCACY

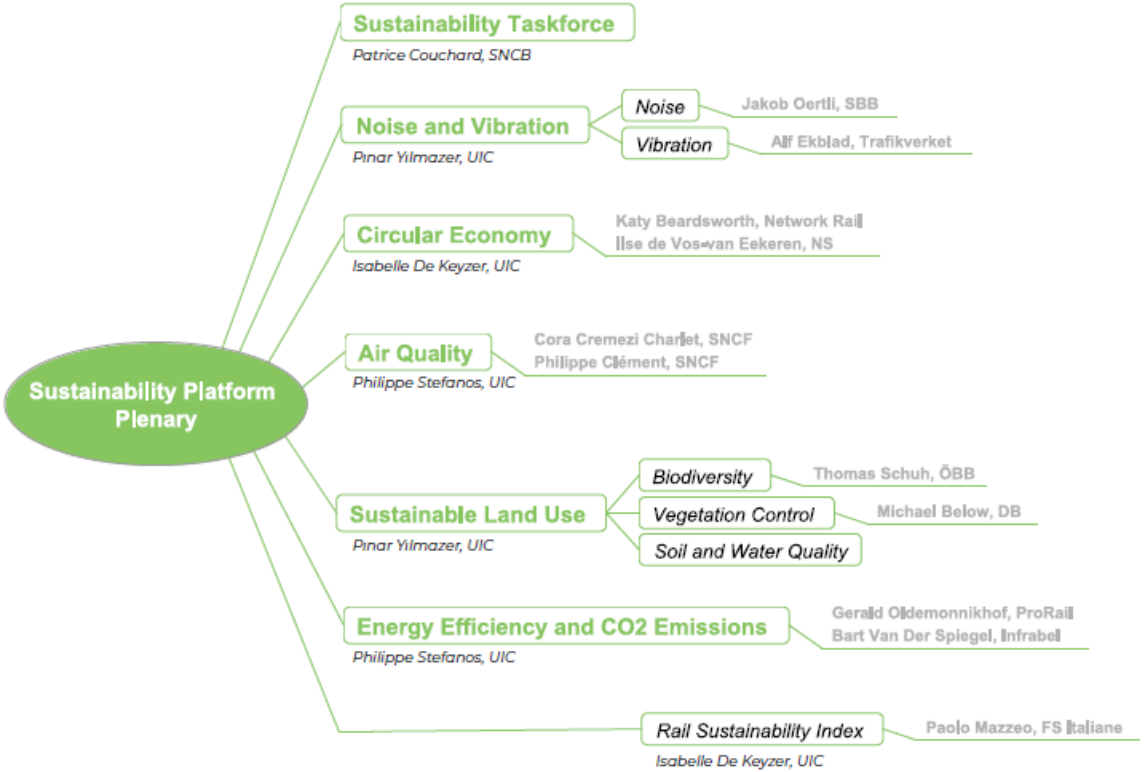
Strategic Objectives



Sustainability

Chair
Christine Vanoppen
Lineas
christine.vanoppen@lineas.net | +32 485 542 548

Person in charge at UIC
Lucie Anderton
Head of Sustainability Unit
anderton@uic.org | +33 144492085 / +33 635135599



Circular Economy Sector

UIC Experts group set up in May 2021
4 meetings up to now
Co-curator of the ZERO WASTE RAILWAYS workshops

Sector Chair

Katy Beardsworth
Environmental Strategy Manager Network Rail

Co-Chair

Ilse de Vos van Eekeren
Program Manager Circular Business
Nederlandse Spoorwegen

MISSION STATEMENT

The UIC Circular Economy Sector provides a platform for the railway community
to incorporate circularity into the rail sector
to accelerate the transition towards a **worldwide circular (zero-waste) railway by 2035**!

VISION

The UIC Circular Economy Sector **collaborates** towards a sustainable and circular economy for the future,

By encouraging **innovation** and product **redesign**, with a view to

- **Extend** material life and
- Maximise resource **efficiency**
- **Maintain resource** use within planetary boundaries.

This way the railways will remain the **most sustainable mode of mobility!**

PURPOSE OF THE CE SECTOR

1. Provide a platform for knowledge exchange across the rail sector to support the transition towards circularity in the railway
2. Provide a link/network to other relevant UIC and external working groups to share knowledge and advise on circularity
3. Mapping out policy and legislation regarding circular economy and providing input and lobbying where necessary
4. Adapt common worldwide accepted language and definition for circularity for the railway sector
5. Apply a worldwide accepted and transparent framework and indicators to measure and monitor the Railway's circular performance
6. Together set (an ambitious) common goal and define milestones for the railway sector on circularity
7. Share best-practices of circular design and materials use (recycled / rapidly renewable), optimal (re)use of existing products, and high-quality reuse/recycle of materials
8. Share data and knowledge to identify and replace hazardous and non-recyclable material in the rail sector
9. Share data and knowledge to identify opportunities to close the material loop in the rail sector
10. Define and adopt common principles for the implementation of material passports in the railway sector

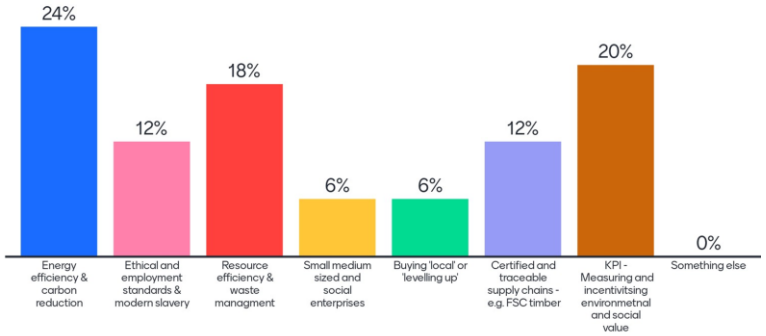
Sustainable Procurement Working group

Chair: Ferdinand ZINSMEISTER

ÖBB-Infrastruktur AG
Senior buyer

Major Projects

Priority topics of the group



Welcoming a worldwide participation

Mission Statement

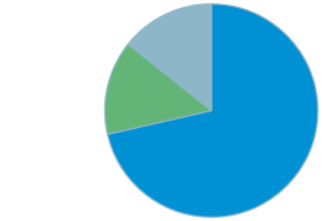
The UIC Sustainable Procurement Working group will provide a platform to convene the railway community with the aim of embedding sustainability into procurement practice and supply chain management in the railway sector.

Vision

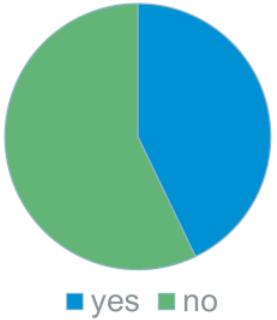
The Rail industry contributes to a more sustainable transport system through influencing and supporting its supply chain and rewarding positive action for sustainability.

Sustainability in procurement processes

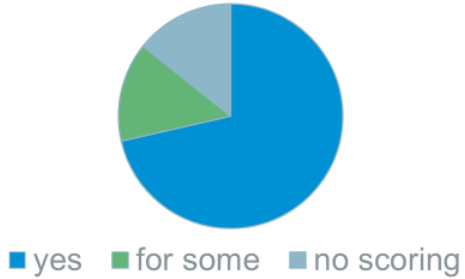
Sustainability in Procurement Strategy



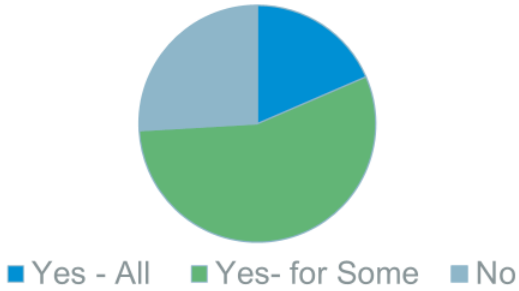
Obligation (legal/ contractual /regulatory)



minimum % weighting to sustainability criteria in tenders



Set contractual requirements for sustainability performance of suppliers?



Code of Conduct for Suppliers

Provide tools, resources, and training to procurement staff to embed sustainability?

Since 2004 “Special Group”

Forum for Purchasing Directors of the Railway Companies of Europe

President
Mr Stefan L. Braun
ÖBB-Infrastruktur AG
Head of Procurement

The European Railways Purchasing Conference

Encourage and support the development of professional purchasing processes

Foster mutual contacts

Working Groups: Main group, Track, Sustainable Procurement

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KEYNOTE

Biomimicry:
Nature-Solutions to Rethink Rail

Dr Arndt Pechstein

1st Zero Waste Railways Workshop, Berlin 1 June 2022

Biomimicry: Nature-based solutions

Dr Arndt Pechstein

Founder & Managing Partner: phi360
Chairman: Biomimicry Academy & Biomimicry Germany

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BEST PRACTICE SHARING

Measuring Circular inflows

SNCF Réseau: Material passports – Rubber pads

Benedicte Gourmandin
Circular economy engineer at SNCF Réseau

UNDER RAIL PADS RUBBER MATERIAL

PRODUCT DESCRIPTION

UNDER RAIL PADS

Figure 1 : Photo of a new under rail pad

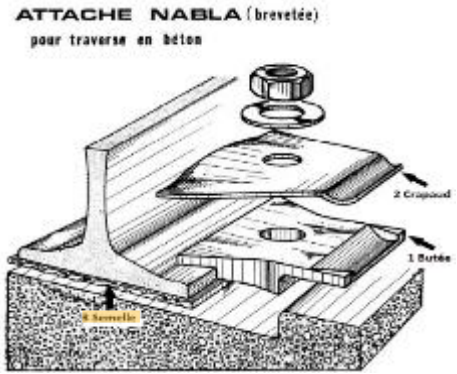


Figure 2 : Drawing of a Nabla connection showing the position of the under rail pad

Under rail pads are used for the elastic connection between the rail and the concrete or wooden sleeper.
Their position allows for a better repartition of the charges and diminish the vibration when a train passes.
The pads also reduce the risk of cracks in the concrete sleepers.

SNCF intern referential:
IG04045 : engineering referential

Norms: NF EN 16730
NF F 50.025 : 1994, NF EN 13481-2, NF EN 13146

Symbols:
21 symbols.
The most commonly used are:

- 09278037 (SR150 – 9x180x148mm)
- 09278036 (SR140 – 9x180x138mm)
- 09278001 (S90 – 9x180x157mm)

Generalities:

- Rubber pads
- Array of size and thickness available, between 4,5 x 180 x 128 mm and 9 x 700 x 240 mm and rolls of 9 x 240 mm x 25 m.
- A panel of approved suppliers : SEMPERIT, MRE, SOGO (not in production but wants to start again).

PADS DESCRIPTION

Désignation de la semelle	Types de semelle	Numéros de symbole	Dimensions
ST	Semelle très souple ST150	-	9x180x148mm Semelle pour rails 60E1
SS	Semelle souple SS150	-	9x180x148mm Semelle pour rails 60E1
SR	Semelle de référence SR150	0.927.8037	9x180x148mm Semelle pour rails 60E1
	Semelle de référence SR140	0.927.8036	9x180x138mm Semelle pour rails 50E6
	Semelle de référence SR134	A paraitre	9x180x132mm Semelle pour rails 46E6
SD	Semelle dure SD150	A paraitre	9x180x148mm Semelle pour rails 60E1
	Semelle dure SD140	0.927.8039	9x180x138mm Semelle pour rails 50E6
	Semelle dure SD134	0.927.8038	9x180x132mm Semelle pour rails 46E6
S45	Semelles tous rails	0.927.8000	4,5x180x165mm
	Semelles pour rails 60E1	0.927.8020	4,5x180x148mm
	Semelles pour rails 50E6	0.927.8025	4,5x180x138mm
	Semelles pour rails 46E2 & 55E1	0.927.8027	4,5x180x132mm
	Semelles pour rails 45,520EV & 46Est	0.927.8028	4,5x180x128mm
	Semelles pour appareils de voie.	0.927.8029	4,5x180x148mm
S90	Semelles tous rails	0.927.8001	9x180x165mm
	Semelles pour appareils de voie	0.927.8043	9x360x240mm
	Semelles pour appareils de voie	0.927.8044	9x450x240mm
	Semelles pour appareils de voie	0.927.8045	9x560x240mm
	Semelles pour appareils de voie	0.927.8046	9x700x240mm
	Semelles pour appareils de voie	0.927.8047	9x220x240mm
	Semelles en rouleau de 25m	0.927.8040	9x240mm x 25m

Figure 3 : pads dimensions depending on their symbols (Source : IG04045 referential)

ST and SS used when the railway transitioned between a track with ballast and a track without (pads without symbols).

SR and SD : non overhanging pads of 9 mm thickness for concrete sleepers. These are used in particular cases such as a connection with nabla evolution or with wooden sleeper in a tunnel

weight = 320 g

SD : these are similar to the SR but harder and used in tight curves.

S45 : pads with a thickness of 4,5 MM. they are mostly use on wooden sleepers. But can be used for concrete sleeper with an indirect connection system using metal saddle.

Weight = 170 g

S90 : pads with a thickness of 9 MM for concrete sleepers.
The overhanging pad for all rail is the most commonly used. The others are for switching tracks.

They also can be use on wooden sleepers in tunnels

PADS DESCRIPTION

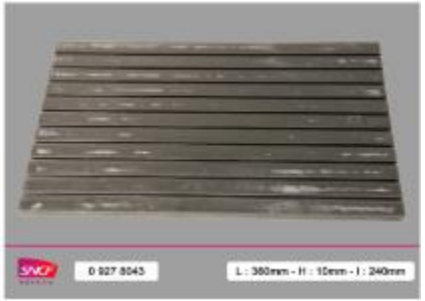


Figure 4 : SR pad

Figure 6 : SD pad

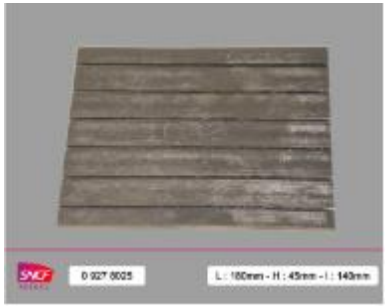


Figure 8 : S45 pad

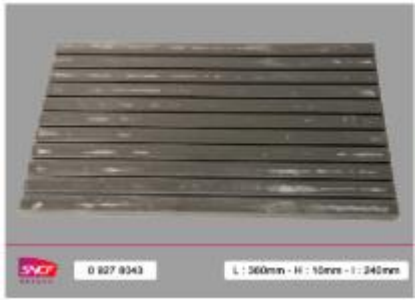


Figure 5 : S90 pad

Figure 7 : 09278035 pad (Type not specified in previous slide)

Figure 9 : 79631244 pad (Type not specified in previous slide)

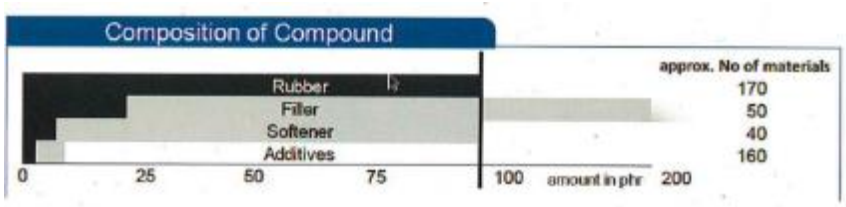
PADS COMPOSITION

INDUSTRIAL RUBBER (SOURCES: AUTHORIZATION FILE OF SEMPERIT PADS AND MN RUBBER)

original industrial rubber pads

- Elastomer type polymer: SBR
- Carbon black (different type used alos, furnace black is the most commonly used in that case)
- Plasticizer
- additives (Vulcanizer)

Quantities details of SEMPERIT pads



phr = parts per hundred of rubber

RUBBER PADS USAGE

2018 DATA (INFRARAIL)

Symbol	Type of pads	thickness	Mass (gram)	Number of pads /an	Total Mass (gram)	Total Mass (Tons)
9278000	S45	4,5	170	170 000	28900000	28,9
9278001	S90	9	320	1 000 000,00	320000000	320
9278020	S45	4,5	170	150 000,00	25500000	25,5
9278025	S45	4,5	170	500 000,00	85000000	85
9278027	S45	4,5	170	120 000,00	20400000	20,4
9278028	S45	4,5	170	20 000,00	3400000	3,4
9278029	S45	4,5	170	200	34000	0,034
9278035	?	4,5	170	200	34000	0,034
9278036	SR	9	320	100 000,00	32000000	32
9278037	SR	9	320	100 000,00	32000000	32
9278038	SD	9	320	8 000,00	2560000	2,56
9278043	S90	9	320	300	96000	0,096
9278044	S90	9	320	500	160000	0,16
9278045	S90	9	320	400	128000	0,128
9278046	S90	9	320	500	160000	0,16
9278047	S90	9	320	100	32000	0,032
79631244	?	4,5	170	1 000,00	170000	0,17
Total				2 171 200		551

Figure 10 : quantities of rubber pads delivered on construction site by the national store in 2018 depeding on their symbols (Source : INFRARAIL data)

- 2 171 200 pads delivered to St Dizier store in 2018, (equivalent to 551 Tons of rubber)
- Plus 2 730 000 pads directly sent to sleeper manufacturers (approximately 690 Tons)
- **Total of 4 901 200 pieces , or 1243 Tons**
- For comparison purpose, the tyre deposit is 350 000 t/year

RUBBER PADS USAGE

QUANTITIES OF PADS BOUGHT IN 2018 AND 2019

There is a downward trend the data of 2020 will bring confirmation

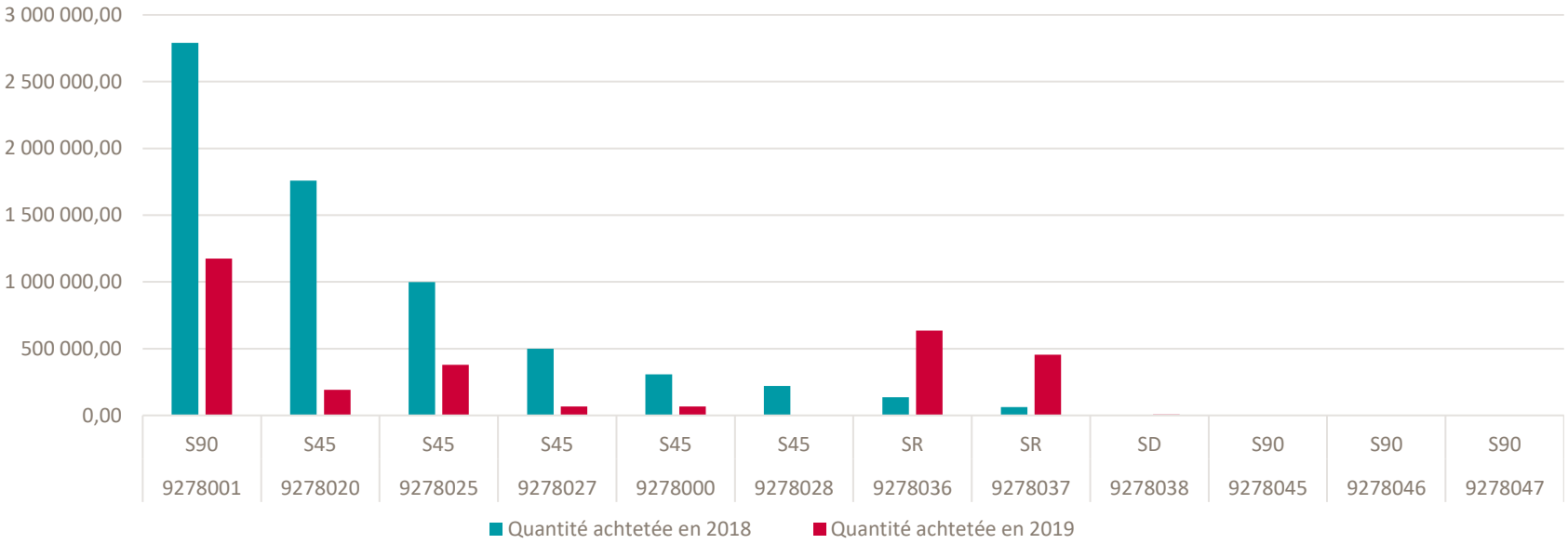


Figure 11 : Histogram of Quantities of pads bought in 2018 and 2019 depending on their symbols (Source : INFRARAIL data)

PRICE AND SUPPLIERS

PURCHASE PRICE BY SYMBOL

- The purchase price depends on the size of the pad
- from 0,39 euros to 2 euros for the smaller sizes
- from 2 to 16,2 euros for the bigger sizes
- Main suppliers: SEMPERIT, MRE, SOGO

Symbol	Type de pads	Full price UD	Price/Unit	Distribution unit
9278036	SR	17,37	0,79	Paquet de 22 pièces
9278037	SR	17,45	0,79	Paquet de 22 pièces
9278038	SD	41,87	1,90	Paquet de 22 pièces
9278001	S90	39,82	0,80	Sac de 50 pièces
9278047	S90	3,83	3,83	Unité
9278044	S90	6,99	6,99	Unité
9278045	S90	7,63	7,63	Unité
9278043	S90	5,51	5,51	Unité
9278046	S90	10,13	10,13	Unité
9278028	S45	39,95	0,40	Sac de 100 pièces
9278027	S45	43,23	0,43	Sac de 100 pièces
9278025	S45	44,24	0,44	Paquet de 100 pièces
9278020	S45	46,93	0,47	Sac de 100 pièces
9278000	S45	52,60	0,53	Sac de 100 pièces
9278029	S45	102,02	2,04	Sac de 50 pièces
9348020	S45	16,21	16,21	Unité
9278039		67,03	3,05	Paquet de 22 pièces
79631244		59,60	0,60	100 pièces
9348035		6,05	6,05	Unité
9278035		1742,30	1742,30	Unité

Figure 12 : pads prices depending on their symbols (Source : price list of 2021 INFRARAIL)

PACKAGING

The pads are packaged by 22, 50, 100 or by unit depending on their type

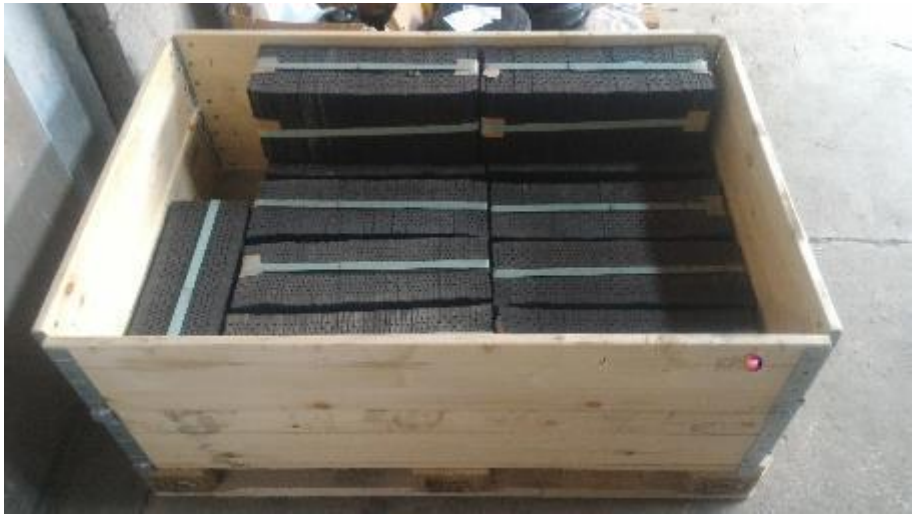


Figure 13 Example of packaged pads by 100

PADS END OF LIFE

END OF LIFE COLLECTION AND STORAGE

pads end of life

- Life expectancy of approximately 25 years depending on the type of pad
- End of life state:

Figure 14 : Photo of a used under rail pad

pads collection and storage

- Used pads are stored on construction site base and in material counter in mesh box ot in skip for non-hazardous waste

Figure 15 : used pads in mesh box

Figure 15 bis : used pad in non hazardous waste skip

PAD MANAGEMENT ON CONSTRUCTION SITE

Pads can stay stuck to the sleepers or underneath the rail or can be mix with the ballast. We ought to sort the rubber pads in order to recycle them but also keep the ballast, sleepers or rails to be « polluted » by used pad.

Figure 16 : used pads mix with ballast

Figure 17 : used pads stuck underneath the rail

Figure 18 : used pads stuck to concrete sleeper

END OF LIFE POSSIBLE TREATMENT

Rubber is a 100% recyclable material.

End of life disposal options:

- Collection of the used pads by the industries using recycled rubber
- Collection of the used pads by the suppliers
- Reuse base on the state of the used pad
- Incineration (3 tons of rubber equals 2 tonnes of fuel)

Restraints :

- Collection site must be close to the deposit site to avoid the environmental and financial cost of logistic
- Group the used pad to constitute a big enough deposit that could attract an enterprise using recycled rubber
- Sorting on site
- The recycled rubber sector is saturated by used tyres and new industrial rubber waste
- Iron pollution and concrete dust

Enterprise using recycled rubber:

- PANDROL
- HET élastomère
- PHENIX technologies
- ROLL GOM
- Entreprise de fabrication de chaussure éco (VEJA)

END OF LIFE COST

Currently, the rubber pads are thrown away as non hazardous waste to be buried or incinerated. The end of life price is of **150€ per ton**, to which is added the transportation price.

Figure 20 : used pad in non hazardous waste skip

An alternative would be to use the services of a company for the valorisation of rubber.

The estimate below was made by the Brussels-based company CCB for a collection site in Lerouville (55) and valorisation sites in Ferrière la Grande (59) and Migennes (89)

The cost of collection, excluding transport, is estimated at 250 euros per ton, which is higher than the current end-of-life price

Budget estimatif :

Estimation données SNCF :

Semelles

1 forfait « camion »	1 120€/camion	1 120,00€
Estimation à 9,5 tonnes*	250€/tonne	2 375,00€

* maximum

0 Acheminement engin de manutention spécifique (chargeur)	898,38	0,00€
0 forfait d'utilisation camion faible tonnage (type 6x4)	528,46	0,00€
0,5 forfait journalier d'utilisation du chargeur	1 056,92	528,46€
	TOTAL	**4 023,46€**

Figure 21 : Extract of the estimate price for the collection of 9,5 tons of rubber by CCB

ENVIRONMENTAL IMPACT

SUSTAINABLE DEVELOPMENT REVIEW

- Rubber wastes, excluding tyres are typically recovered for energy purposes. They are incinerated
- Waste nomenclature: 07 01 99/ 17 02 03

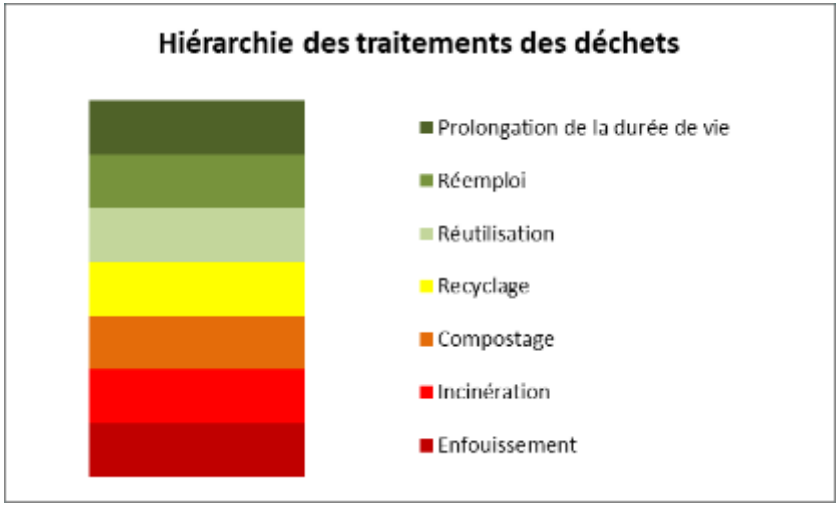


Figure 19 : Waste treatment hierarchy

CONTACTS

Internal contacts

- Technical manager for under rail pad for concrete sleeper: ROLLAND Elodie
- Technical manager wooden sleeper: LOMBAREY Olivier
- INFRARAIL: LIABEUF Christophe
- Buyer of pads: PONT Fanny

External contacts:

- Under rail pad supplier: SEMPERIT, MRE et SOGO
- Enterprise MRE : Philippe PERRIER pperier@mnrubber.com
- Enterprise SEMPERIT : Catherine DANTAN Catherine.Dantan@semperitgroup.com
- Enterprise SOGO : Béatrice LUCET - DOUNAS scoflex-marine@wanadoo.fr

NS: Measuring circular inflows and material passports for trains

Ilse de Vos-Van Eekeren,
Program Manager Circular Business
Nederlandse Spoorwegen

On track towards 100% circular trains

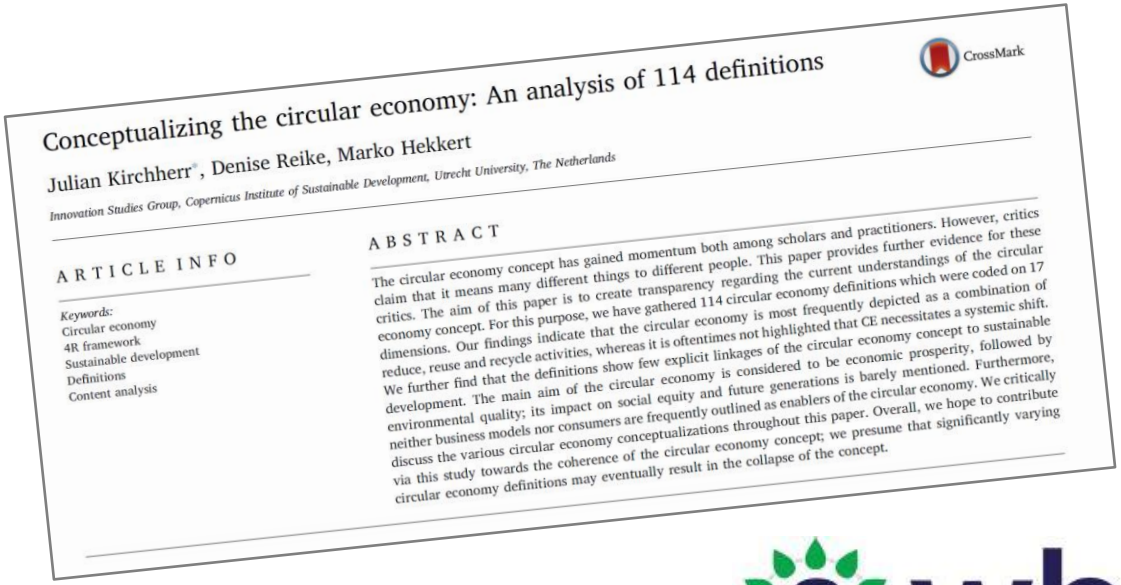
Dutch Railways (NS)

Ilse de Vos van Eekeren

Manager Circular Business

Berlin, June 2022

Definition



Conceptualizing the circular economy: An analysis of 114 definitions

Julian Kirchherr*, Denise Reike, Marko Hekkert

Innovation Studies Group, Copernicus Institute of Sustainable Development, Utrecht University, The Netherlands

ARTICLE INFO

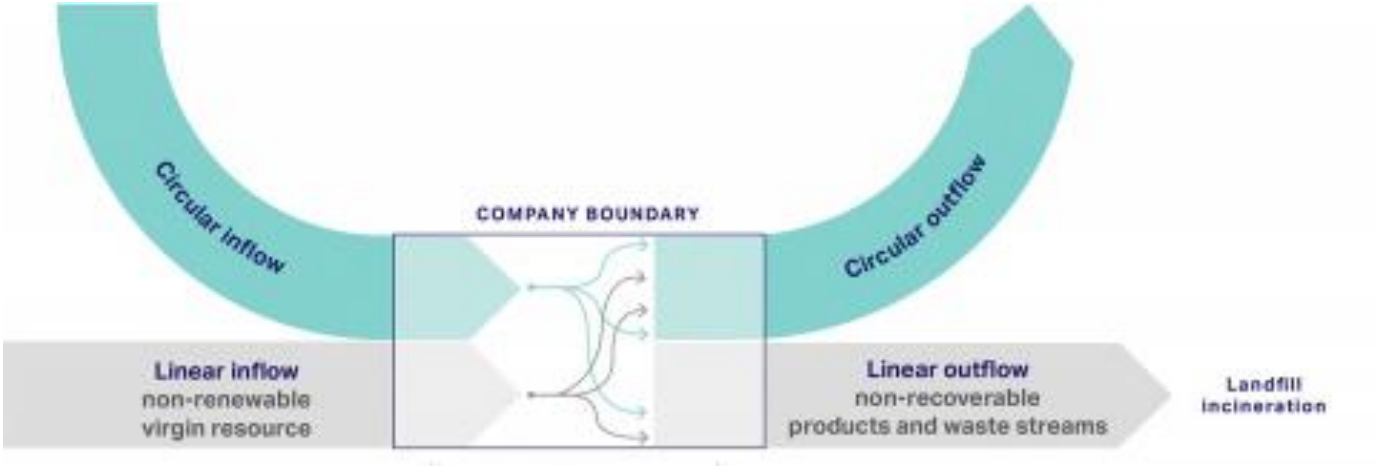
Keywords:
Circular economy
4R framework
Sustainable development
Definitions
Content analysis

ABSTRACT

The circular economy concept has gained momentum both among scholars and practitioners. However, critics claim that it means many different things to different people. This paper provides further evidence for these critics. The aim of this paper is to create transparency regarding the current understandings of the circular economy concept. For this purpose, we have gathered 114 circular economy definitions which were coded on 17 dimensions. Our findings indicate that the circular economy is most frequently depicted as a combination of reduce, reuse and recycle activities, whereas it is oftentimes not highlighted that CE necessitates a systemic shift. We further find that the definitions show few explicit linkages of the circular economy concept to sustainable development. The main aim of the circular economy is considered to be economic prosperity, followed by environmental quality; its impact on social equity and future generations is barely mentioned. Furthermore, neither business models nor consumers are frequently outlined as enablers of the circular economy. We critically discuss the various circular economy conceptualizations throughout this paper. Overall, we hope to contribute via this study towards the coherence of the circular economy concept; we presume that significantly varying circular economy definitions may eventually result in the collapse of the concept.

wbcsd

Measure

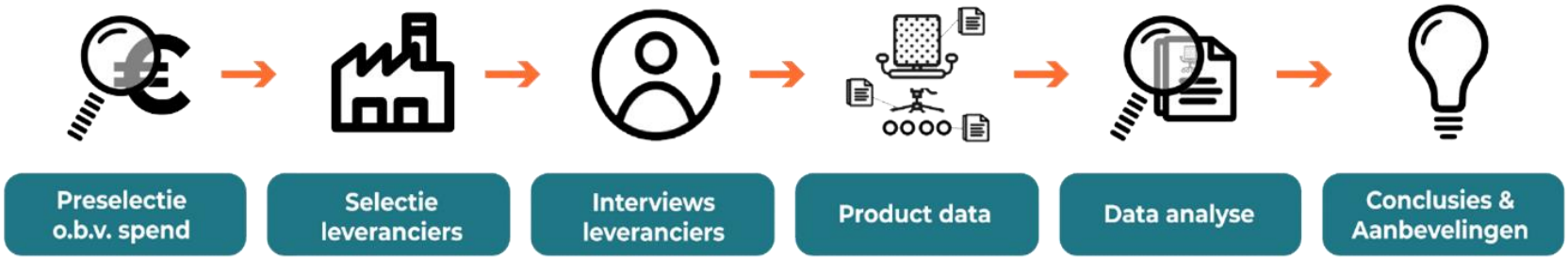


KPI’S **% Circulaire Inflow** **% Circulaire Outflow**

OGSM

Annual report

INFLOW-REPORT

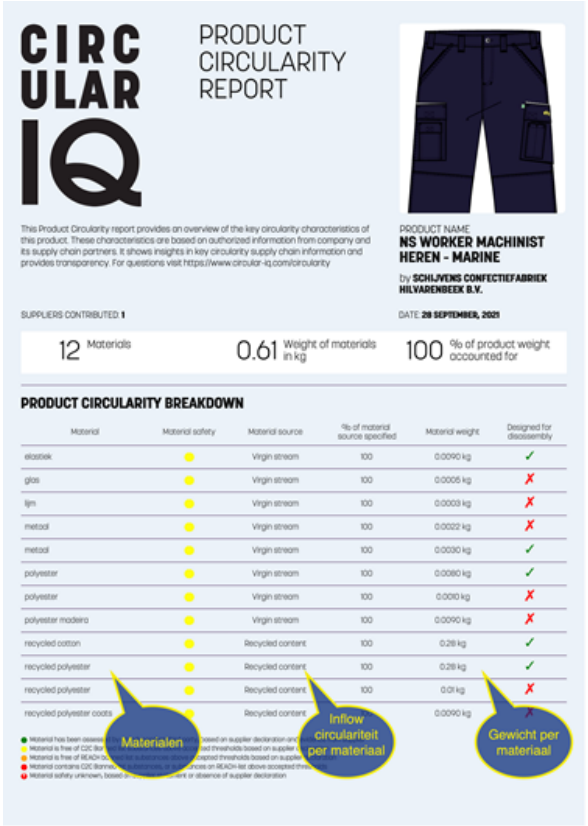


2020 13%

2021 73%

- 51.801,9 ton kg
- 26 suppliers
- 63% circular

Procurement-level



CIRC ULAR IQ

PRODUCT CIRCULARITY REPORT

This Product Circularity report provides an overview of the key circularity characteristics of this product. These characteristics are based on authorized information from company and its supply chain partners. It shows insights in key circularity supply chain information and provides transparency. For questions visit https://www.circular-iq.com/circularity

PRODUCT NAME
NS WORKER MACHINIST HEREN - MARINE

by **SCHIJVENS CONFECTIEFABRIEK HILVARENBEEK B.V.**

SUPPLIERS CONTRIBUTED: **1**

DATE: **28 SEPTEMBER, 2021**

12 Materials	0.61 Weight of materials in kg	100 % of product weight accounted for

PRODUCT CIRCULARITY BREAKDOWN

Material	Material safety	Material source	% of material source specified	Material weight	Designed for disassembly
elastiek		Virgin stream	100	0.0090 kg	✓
glas		Virgin stream	100	0.0005 kg	✗
lijm		Virgin stream	100	0.0003 kg	✗
metaal		Virgin stream	100	0.0022 kg	✗
metaal		Virgin stream	100	0.0030 kg	✓
polyester		Virgin stream	100	0.0080 kg	✓
polyester		Virgin stream	100	0.0010 kg	✗
polyester modeira		Virgin stream	100	0.0090 kg	✗
recycled cotton		Recycled content	100	0.28 kg	✓
recycled polyester		Recycled content	100	0.28 kg	✓
recycled polyester		Recycled content	100	0.01 kg	✗
recycled polyester coats		Recycled content	100	0.0090 kg	✗

Materialen

Inflow circulariteit per materiaal

Gewicht per materiaal

Circular Trains

Circular Requirements

- Definitions, Measure system, standards (ISO)
- Materials passport
- Circular design
- Circular materials
  - % circular inflow & process
  - > 95% circular outflow (explanation last <5%)
- process agreement optimization circular design and material use **together**

EuroSpec SNCF Rail Delivery Group DB ÖBB SBB CFF FFS

Next step…

Outflow becomes inflow → Close the loop.


Deze treinvloer heeft 5,7 miljoen km door Nederland gereden.

Circulair inkopen 19 April 2022


Dit bureaublad was eerst een
treinplafond van NS

Case Study: Materials Circularity Indicator for Sleepers

Katy Beardsworth
Environmental Strategy Manager Network Rail

Case Study: Using the Material Circularity Indicator tool to measure circularity of railway sleepers

Katy Beardsworth, Environmental Strategy Manager

The Material Circularity Indicator Tool

- **The Material Circularity Indicator (MCI) was developed by the Ellen MacArthur Foundation, in 2019**
- **The tool measures how restorative the material flows of a product are**
  - In the context of the circular economy, 'restoration' relates to the 'reusability', 'repairability', and 're-cyclability' of a product/material.

The tool calculates a 'circularity' score based on the following product criteria:

Feedstock	Destination after use
Percentage reused	Percentage reused
Percentage recycled	Percentage recycled
Recycling efficiency	Recycling efficiency
Lifespan (number of times industry average)	
Functional units (number of times industry average)	

CIRCULARITY INDICATORS

AN APPROACH TO MEASURING CIRCULARITY

Material Circularity Indicator

Dynamic Modelling Tool

Drag the sliders to change input values and see how the MCI changes!

	Feedstock	Destination after use
Reused	0%	0%
Recycled	0%	0%
Recycling efficiency	0%	80%

Lifespan	0.9 x industry average
Functional units	1.0 x industry average

#DIV/0!

ELLEN MACARTHUR FOUNDATION

GRANTA MATERIAL INTELLIGENCE

Life

Using the tool for a rail product

Why are we investigating the use of the tool?

- Want a way of comparing rail products potentially to help internal customers inform their procurement choices
- Uncertain as to whether the tool would function in a rail context
- Other measures (e.g. carbon, recycled content) do not give the full picture

Which products are we evaluating

Concrete

Fibreglass

Timber

Steel

HDPE composite plastic

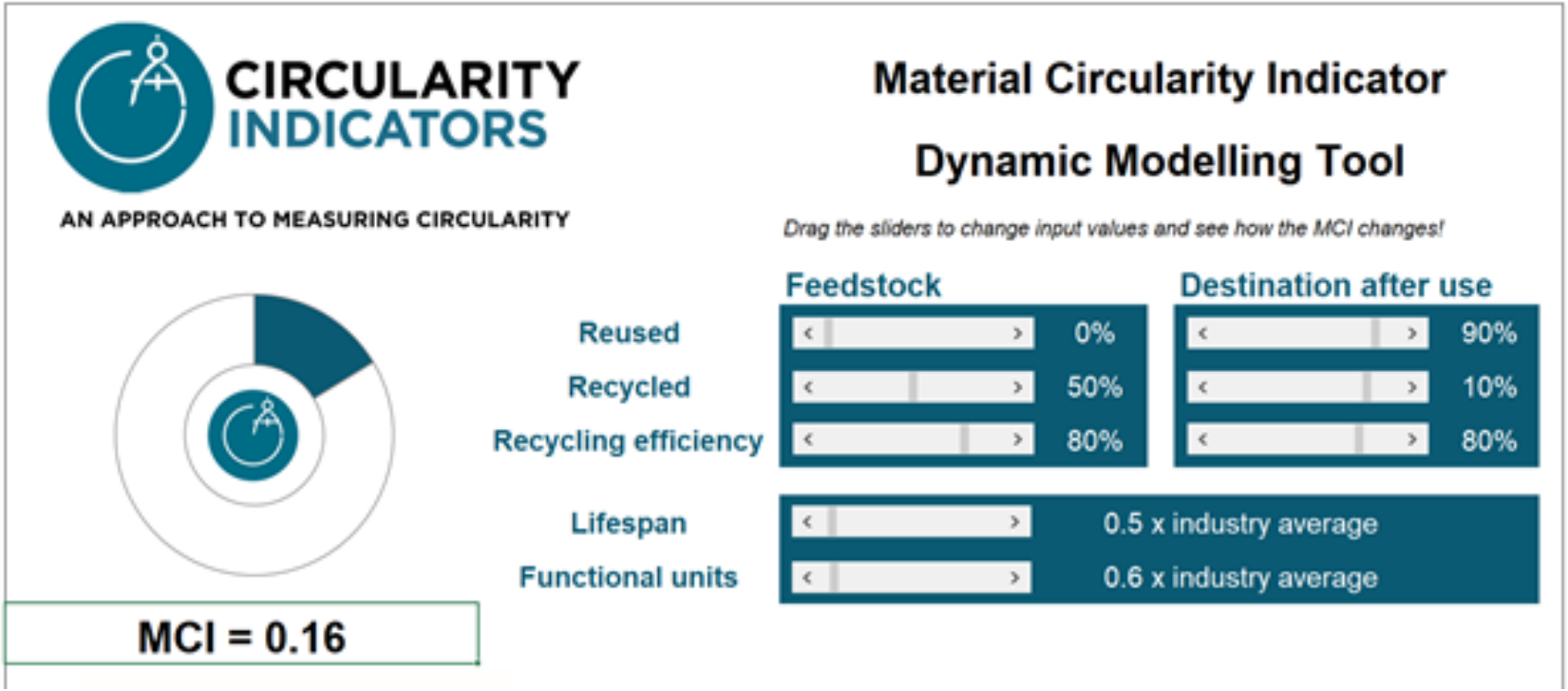
Results and Discussion points

We cannot share exact results as the data is commercially sensitive

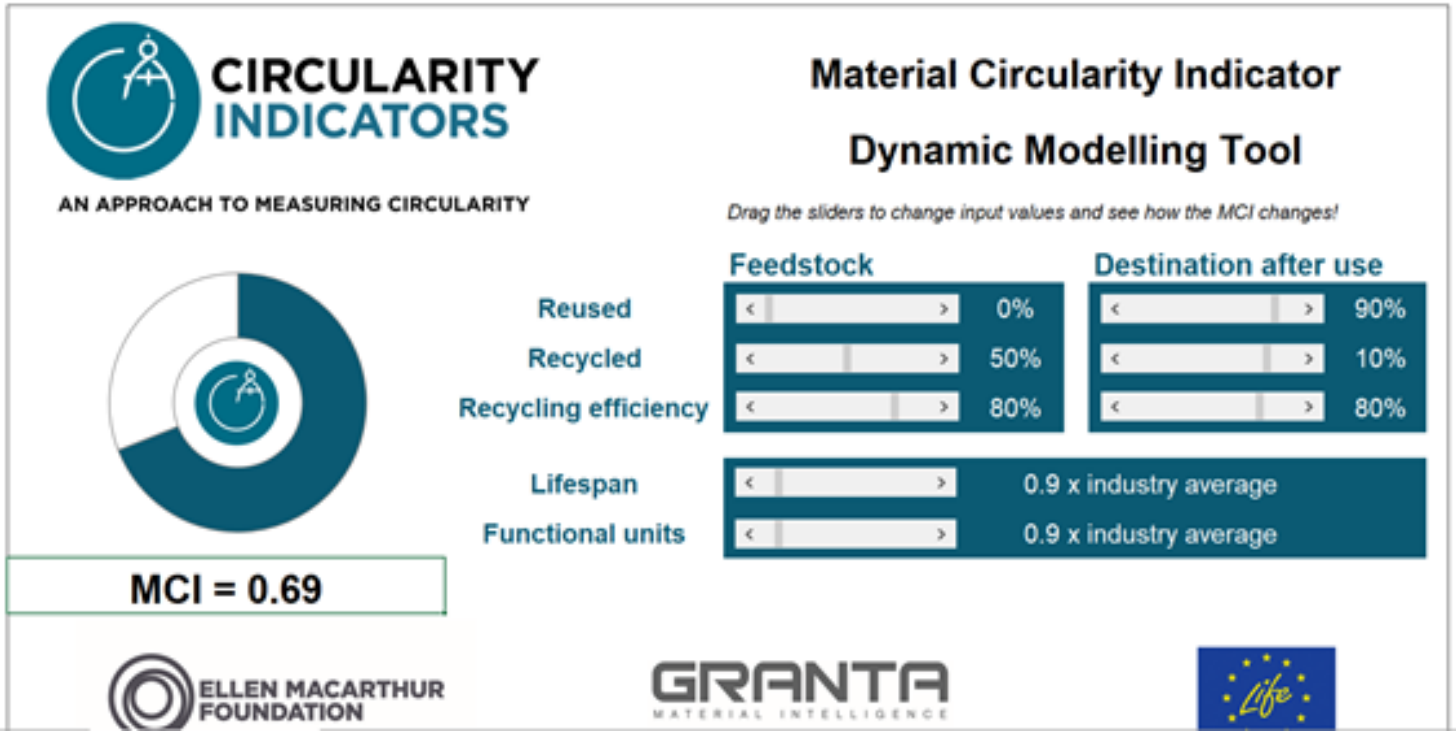
Discussion points

- Granularity of data required
- Length of our product lifecycles
- Lack of recycling efficiency data
- Overinflation of functional units/ lifespan values

Demonstration: weighting of functional units/lifespan is key



Here the same feedstock/end of life info has been used – but the FU and lifespan have been altered which drastically changes the overall score..



Next steps

- Provide feedback to the Ellen MacArthur Foundation on our experience of using the tool

ELLEN MACARTHUR FOUNDATION

- Investigations into new calculation to give end of life outcomes more prominence (but this would no longer be the MCI tool)

BREAK
(30 mins)

BEST PRACTICE SHARING

Circular Successes

Wheel sets – CO2 and Circular Economy benefits

Joris van De Sande,
Sustainable procurement consultant
Department of Innovation and development within NS procurement
NS

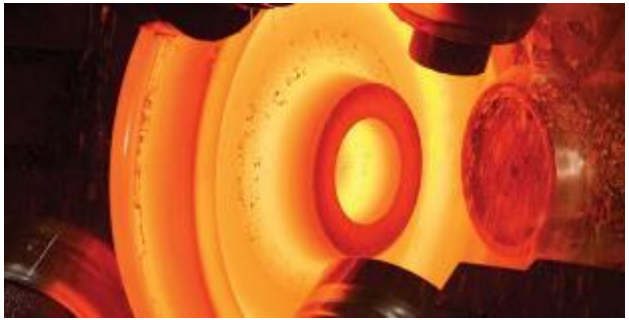
Wheel sets – CO2 and Circular Economy benefit

Joris van de Sande

Procurement consultant

Innovation and Development

Case: Carbon footprint Tender wheels



Carbon footprint in awardmodel

- Award model:
  - price (65%)
  - Project management (25%)
  - **Carbon-footprint (10%)**

- Carbon-footprintmodel:
  1. **% usage of recycled steel**
  2. Energy usage during casting en post-processing
  3. Transport from production location to NS

Result Carbon-footprint per whee

Category	Su	pplier 2	Leveranci
Recycled steel	kg	41% → 405 kg CO_2	0%
	kg CO_2	105 kg C	able
	90% train → 15 kg CO_2	10	0% roadtransport → 100 kg CO_2
Totaal	320 kg C	kg CO_2	n/a

525.000 KG Co2 reduction

97.222 pieces

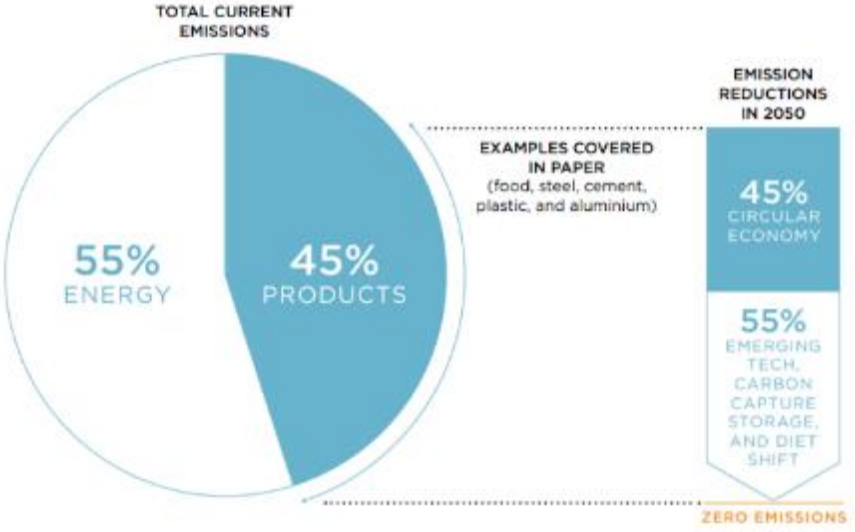
320.000 KG less 'virgin' STEEL

-/-160.000 kg Cokes

-/-520.000 kg iron

Takeaways from Tender….

- Frame the complex world into a simple model
- As a customer you can choose, as there are differences between suppliers
- Climate neutral focus on energy usage and circularity.



Source: Ellen MacArthur Foundation (2018), Completing the picture

We learned after the tender that our supply chain became more resiliant because of the closed loop

SBB Center of Competence for Circular Economy

Fabiano Piccino
Head of Circular Economy Center of Competence
SBB

Circular Economy Center of Competence

SBB – Swiss Federal Railways

1st Zero Waste Railways workshop

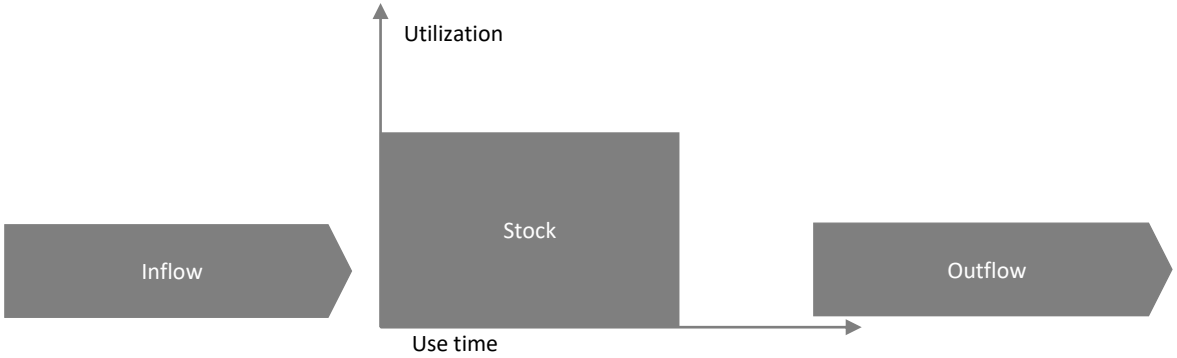
Berlin, 1 June 2022

Dr. Fabiano Piccinno

Head of Circular Economy Center of Competence

SBB is a material mine with a large CE potential

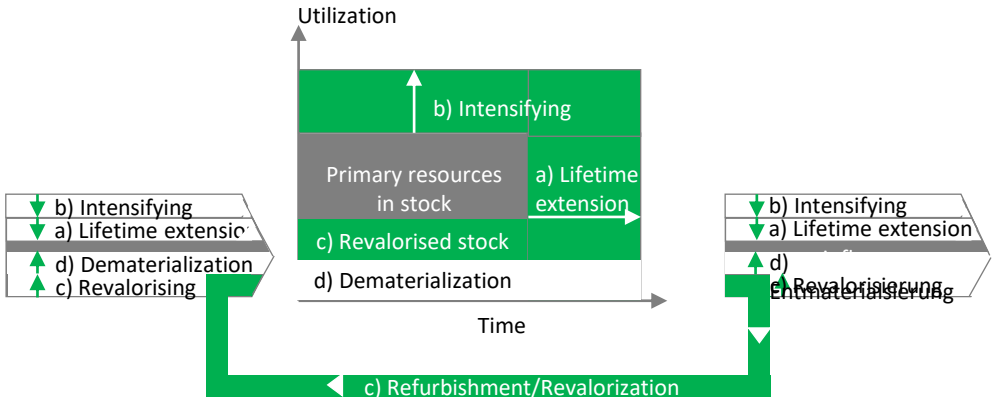
Implementing CE measures has an impact on inflow and scope 3 emissions.



240’000 t CO_2 eq raw material level
870’000 t CO_2 eq product level

23’700 t CO_2 eq waste mgt

CE measures are critical to achieve scope 3 goals.



33'000 t CO_2 eq raw material level
290'000 t CO_2 eq product level

Through CE measures (without changing the supplier's energy source) alone, SBB has a potential to reduce GHG emissions by **580'000 t CO2 eq** (66 %).

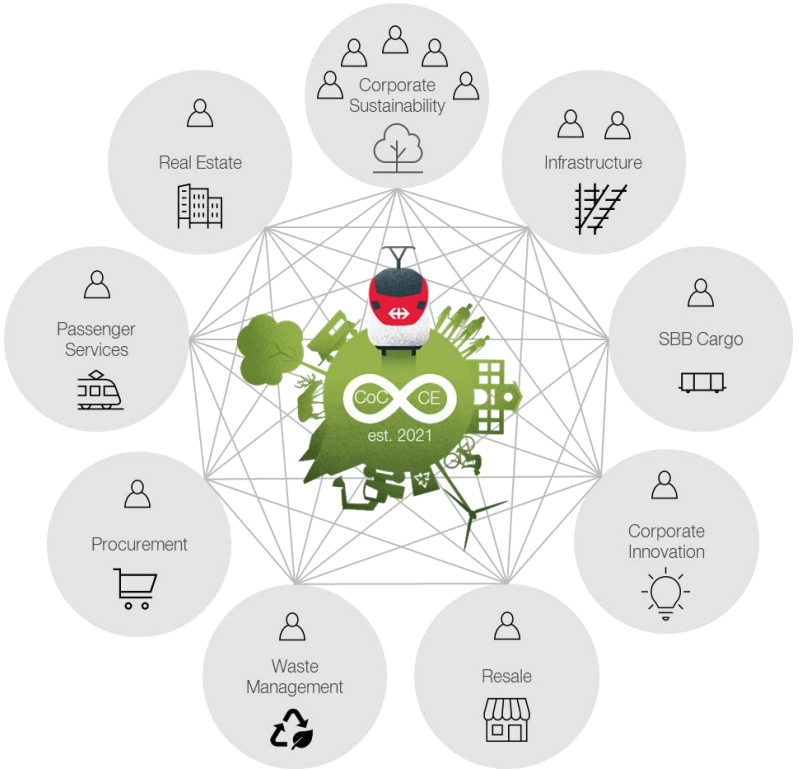
Circular Economy Center of Competence – a cross-functional team to implement the strategy

Management and implementation of project portfolio

Change management

Communication

Program Management
Measuring and scaling impact

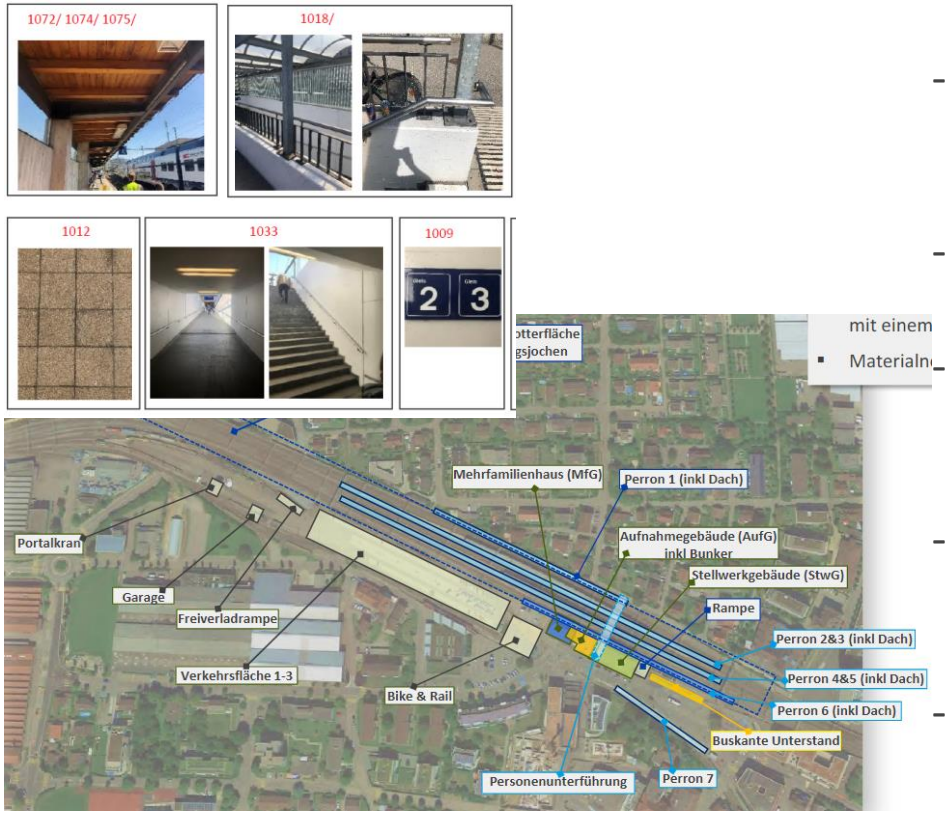


Member of CE Center of Competence

Wooden Rail Engineering Buildings

- Circular material
- Modular, can be de- and reassembled
- PV cells in the façade
- Easily scalable due to high standardization

Component reuse in infrastructure construction projects



- Built inventory of on site materials and evaluated reuse potential
- 31’000 tons of material
- Potential of environmental impact reduction of up to 52 %
- Potential of cost reduction of up to 42 %
- Use as blueprint for future projects

Circular cities and construction in real estate projects

Architectural tender process where we provide digital material passports and ask for:

- Reusing building components
- Circular construction
- Circular concepts (logisitics, mobility, utilization, energy, waste treatment)

Blueprint for future area developments

Criteria for product-as-a-service procurement

Step 1

Value

Use

Market

Step 2

Future market

Product

Costs & Organisation

Ecology

Ongoing examples

Washing machine as a service

+ Investment → Expenditures
+ Lower costs
+ Lower internal expenditures and less bureaucracy
+ Direct contact with renter

Light as a service

+ Lower energy consumption (Incentives)
+ Use of reused light material
+ Fix service costs
+ Overall lower costs

New circular services for rail freight logistics

- Logistics concept for Cargo as CE enabler
- Development of new CE services
- Focus on circular construction and waste management sector
- Collaboration with partners

Thank you.

HS2 Circular Economy Strategy

Peter Miller
Environment and Town Planning Director
Infrastructure Directorate
HS2

HS2

HS2 Circular Economy Strategy

Cleaning Up Construction

Peter Miller, HS2 Environment Director

HS2 Strategic Goals

Catalyst for growth

Be a catalyst for sustained and balanced economic growth across the UK.

Capacity & connectivity

Add capacity and connectivity as part of a 21st century integrated transport system.

Value for money

Deliver value to the UK taxpayer and passenger.

Customer experience

Set new standards in customer experience.

Skills & employment

Create opportunities for skills and employment.

Health, safety & security standards

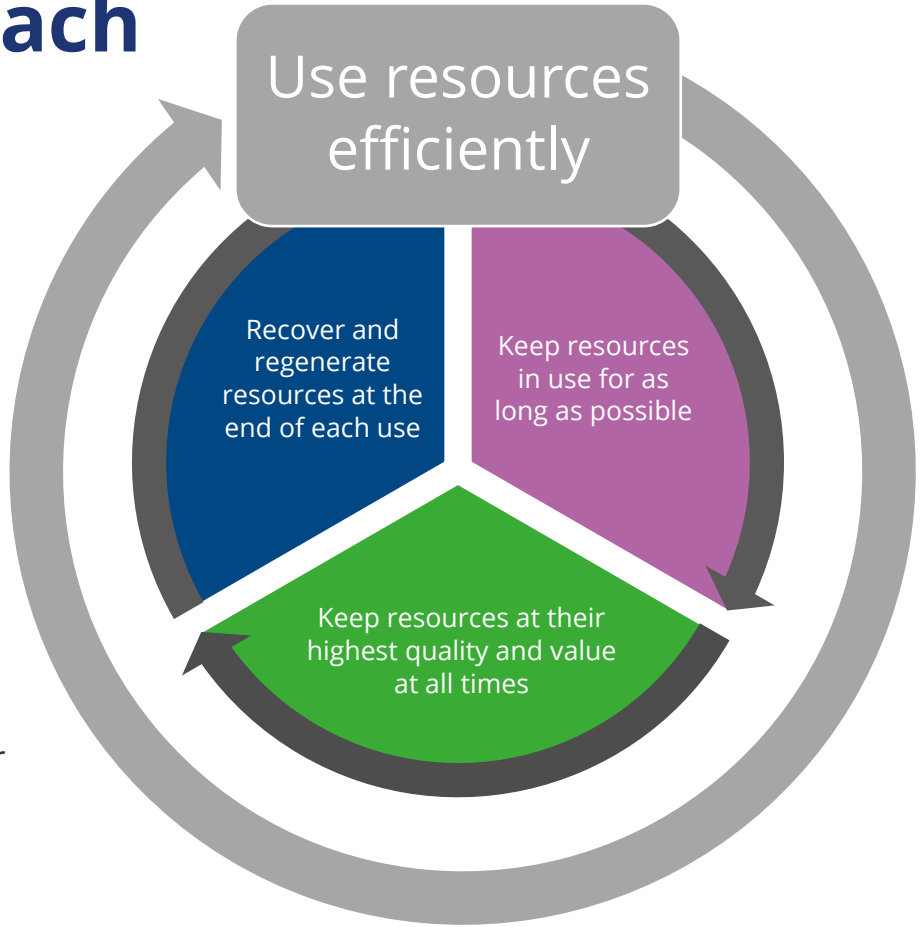
Set new standards in health, safety and security in the construction and operation of the railway.

Sustainable & a good neighbour

Create an environmentally sustainable solution and be a good neighbour to local communities.

HS2 approach

- *Design for reuse*
- *Design for recovery/recycling*
- *Use compostable materials*
- *Product take-back*



- *Design for longer component lives*
- *Design for ease of maintenance*
- *Condition monitoring*

- *Design for reconditioning or remanufacturing*

- *Product-as-service models*

Sustainability Assessments & Circular Economy

BREEAM

The world's leading sustainability assessment method for the built environment

Topics related to CE

Materials

Waste

Water

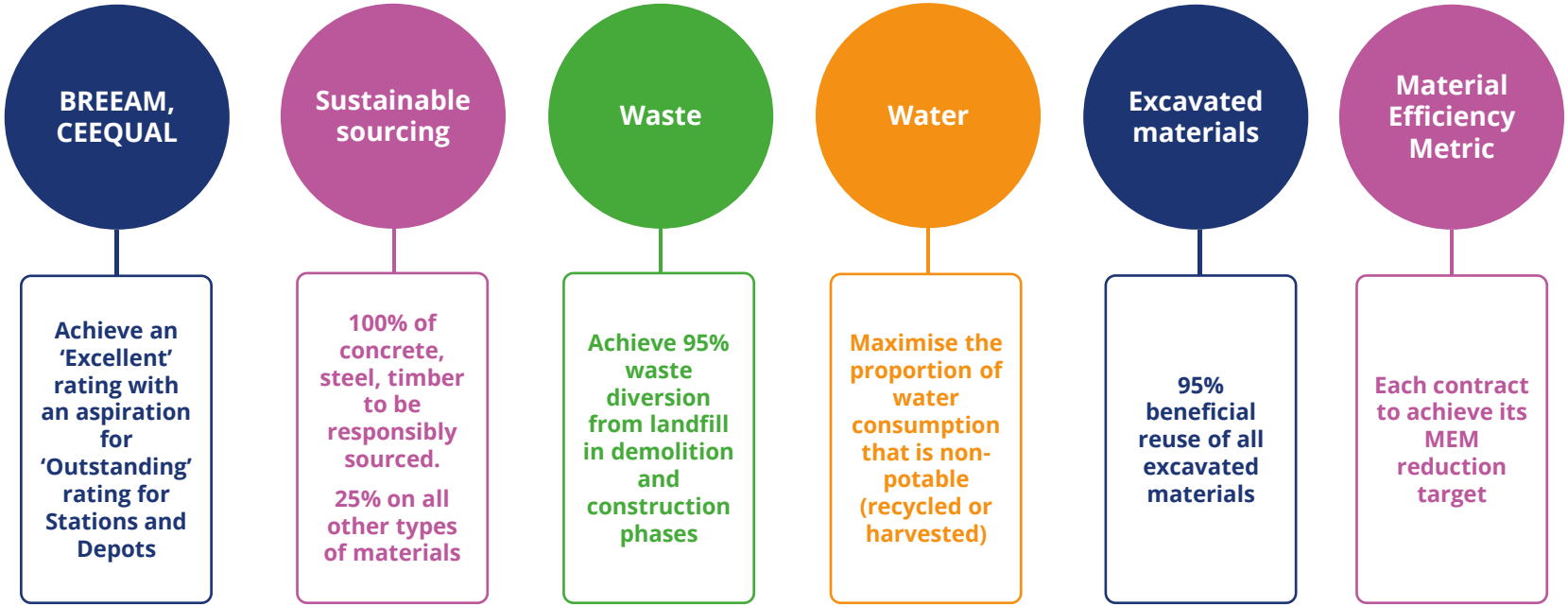
Energy

CEEQUAL

International evidence-based sustainability assessment, rating and awards scheme for civil engineering, infrastructure, landscaping and works in public spaces

CEEQUAL®
delivered by bre

HS2 targets


BREEAM, CEEQUAL
Achieve an 'Excellent' rating with an aspiration for 'Outstanding' rating for Stations and Depots
Sustainable sourcing
100% of concrete, steel, timber to be responsibly sourced.
25% on all other types of materials
Waste
Achieve 95% waste diversion from landfill in demolition and construction phases
Water
Maximise the proportion of water consumption that is non-potable (recycled or harvested)
Excavated materials
95% beneficial reuse of all excavated materials
Material Efficiency Metric
Each contract to achieve its MEM reduction target

Managing Circular Economy Deliverables

Supply Chain Deliverables

- Embedded environmental impacts
- Design for Deconstruction Plan
- Resource management plans
- Recycled Aggregates protocol

Bespoke management tools

- Material Efficiency Metric (MEM)
- Environmental Opportunities Realisation Process (EORP)

Old Oak Common

- BREEAM Excellent – with detailed design currently **targeting Outstanding**.
- Specialist wind tunnel modelling **reduced roof steel by over 27%** (over 1,000t of steelwork).
- Rainwater harvesting.
- Natural and low-carbon ventilation
- **3,215m²** of solar panels.

Cleaning up construction

Biodegradable tree guard

Reduces plastic consumption, operational works to remove permeant tree guard and provides nutrients to the soil as the guard biodegrades.

Use of demolition waste/ excavate materials onsite

Reducing waste removal from site and the need to purchase aggregates whilst also allowing complete quality control of the recycled product.

Realising value of felled timber

Reuse of felled timber through provision to a local community or through commercial agreements with timber merchants.

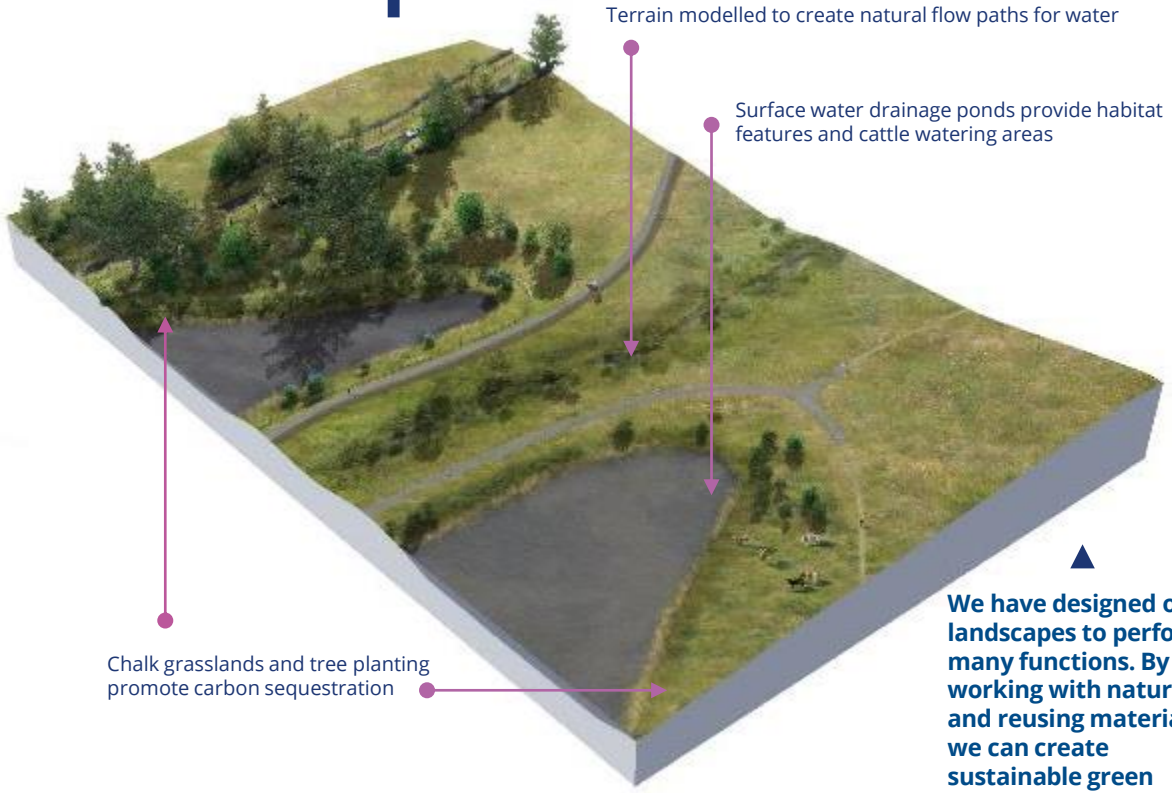
HIPER piles

Innovative solution of piling using hollow, impressed, precast, energy-generating and reusable piles.

Colne Valley Western Slopes

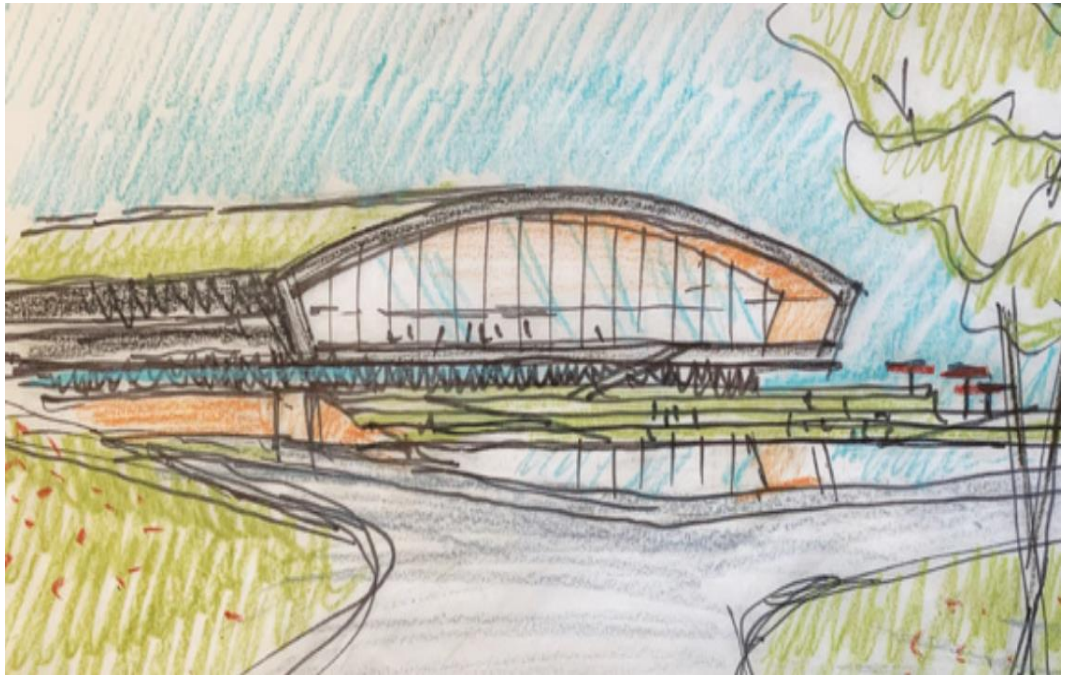
Innovation and Circular Economy is at the heart of our design

- All material (**3million m³**) from the Chilterns tunnel excavation will be spread on the site
- Use of chalk cakes and repurposed temporary works aggregates (limestone / concrete) in our soils
- **88ha** of calcareous grassland and scrub created
- We have developed a long-term management approach which draws upon principles of 'rewilding' to reduce the overall management burden and cost to the environment



We have designed our landscapes to perform many functions. By working with nature and reusing materials we can create sustainable green infrastructure

Calvert Depot Circular Economy Pilot



Integrating circular economy principles

Work at Calvert depot looks at material and design choices from a different perspective.

The circular economy principles are driving the project to look at material choices and service life in different ways.

- Sustainable urban drainage systems (SuDS)
- Rainwater harvesting/ grey water recycling systems
- Use of engineered timber and reused steel
- Renewable energy solution currently under design to meet as much of the electricity demand as practicable.

HS2

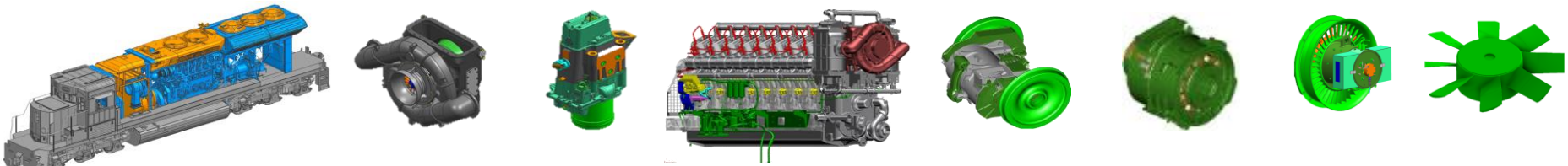
Thank you

WABTEC: Rolling stock and circular practices

Edward “Marty” Thomas
Responsible for Global Freight Services Operations,
Group Vice President Freight, Services Wabtec

ADVANCING A CIRCULAR ECONOMY

Reduce. | Reuse. | Rebuild.



Rolling Stock & Circular Practices

Marty Thomas – Wabtec 6/1/2022

Wabtec CORPORATION

Remanufacturing Circular-Based Economy

Design

- Intent for Reman
- Design for Reman
- Lifecycle | Ware Characteristic
- Customer Spec
- Forecasting

Installed Base

- Telemetry
- Removal | Route
- Duty cycle PM
- Global logistics
- Distro Network
- Used market surveillance

Requalify

- Reman Network
- Teardown tech
- Cleaning tech
- Inspect tech
- Qualification Tech
- Conditional routing

Repair

- Subtractive | Additive
- Cold Metal Transfer
- Laser Cladding | Welding
- Joining Laser | Pulse
- Conv. Weld | Brazing
- Metal Spray
- Metallurgical capabilities

Reassemble

- Digitally Enabled Assembly
- Connected MES sys
- Routing FRID\
- Percent reuse criteria
- Efficiency
- Test Quality

Installed Base

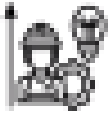
- Redistribute
- Attainment
- PM Routines
- Distro network
- Tracking
- Global & Regional distribution

Life Cycle
How many?

- Market $$
- Internal external
- Global
- Scale over multiple product lifecycles?

Enablers: Digital | 3D Additive | Solutions | Technology | Logistics

Resourcing



Repair Technology

Real time Telemetry

Advanced Diagnostics

Manufacturing & Forecasting Systems

Unpredictable Supply Chain

Improving Customer & Environmental Outcomes

Contribute Customer sustainability targets | Emission reductions per loco/year | Reach Wabtec Corp Sustainability Targets

Wabtec CORPORATION

Today at Wabtec, remanufacturing brings roughly 296 million pounds of end-of-life material back to our global facilities annually, of which:

79%
is reused or remanufactured

20%
is recycled

< 1%
goes to waste

Reduce

In an engine overhaul, **99%** of the weight of the engine is reused, requalified, remanufactured or recycled.

Reuse

More than **50%** of an approximately 400,000-lb locomotive is reused in Wabtec's modernization program.

Rebuild

More than half of a locomotive's critical components will be reused, rebuilt, or remanufactured at least **3 times** over their useful lifespan.

Wabtec CORPORATION

100 YEARS ANNIVERSARY

INTERNATIONAL UNION OF RAILWAYS

Stay in touch with UIC:

www.uic.org

#UICrail

Thank you for your attention.