ZERO WASTE RAILWAYS
WORKSHOP 1
CIRCULAR INFLOWS
AGENDA
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>12.00</td>
<td>Networking lunch (60 mins)</td>
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</table>
| 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
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.
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

Build collaborative partnerships and be the voice of the global railway community to advocate for a multimodal vision of sustainable mobility with rail as the backbone.

Provide a trusted platform for the railway sustainability community to connect.

Provide practical solutions for sustainability challenges for a future railway.
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

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.
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

Encourage and support the development of professional purchasing processes
Foster mutual contacts

Working Groups: Main group, Track, Sustainable Procurement

The European Railways Purchasing Conference

Sustainability in procurement processes

Sustainability in Procurement Strategy

- yes it's central to the mission
- Yes it is mentioned
- No

Set contractual requirements for sustainability performance of suppliers?

- Yes - All
- Yes - for Some
- No

Obligation (legal/contractual/regulatory)

- yes
- no

minimum % weighting to sustainability criteria in tenders

- yes
- for some
- no scoring

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

- Yes
- No
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
KEYNOTE

Biomimicry:
Nature-Solutions to Rethink Rail

Dr Arndt Pechstein
Biomimicry: Nature-based solutions

Dr Arndt Pechstein

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

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

**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.

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<table>
<thead>
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<th>Types de semelle</th>
<th>Numéros de symbole</th>
<th>Dimensions</th>
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<td>ST</td>
<td>Semelle très simple NT150</td>
<td>-</td>
<td>9x180x148mm Semelle pour rails 60F1</td>
</tr>
<tr>
<td>SS</td>
<td>Semelle simple SS150</td>
<td>-</td>
<td>9x180x148mm Semelle pour rails 60F1</td>
</tr>
<tr>
<td>SR</td>
<td>Semelle de référence SR150</td>
<td>0.927 8037</td>
<td>9x180x148mm Semelle pour rails 60E1</td>
</tr>
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<td></td>
<td>Semelle de référence SR140</td>
<td>0.927 8036</td>
<td>9x180x132mm Semelle pour rails 50E6</td>
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<tr>
<td></td>
<td>Semelle de référence SR134</td>
<td>A parasite</td>
<td>9x180x132mm Semelle pour rails 40E6</td>
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<td></td>
<td>Semelle de référence SD134</td>
<td>0.937 8038</td>
<td>9x180x132mm Semelle pour rails 40E6</td>
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<td><strong>S45</strong></td>
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<td>0.927 8000</td>
<td>4.5x180x148mm</td>
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<tr>
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<td>0.927 8025</td>
<td>4.5x180x132mm</td>
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<td>Semelles pour rails 45E2 &amp; 55E1</td>
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<td>9x150x240mm</td>
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<td></td>
<td>Semelles en rouleau de 35m</td>
<td>0.927 8040</td>
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</table>

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

Figure 4: SR pad
Figure 5: S90 pad
Figure 6: SD pad
Figure 7: 09278035 pad (Type not specified in previous slide)
Figure 8: S45 pad
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)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Type of pads</th>
<th>thickness</th>
<th>Mass (gram)</th>
<th>Number of pads /an</th>
<th>Total Mass (gram)</th>
<th>Total Mass (Tons)</th>
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<td>S45</td>
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<td>1 000 000,00</td>
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</tbody>
</table>

Total 2 171 200 551

Figure 10 : quantities of rubber pads delivered on construction site by the national store in 2018 depending 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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Type de pads</th>
<th>Full price UD</th>
<th>Price/Unit</th>
<th>Distribution unit</th>
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<tr>
<td>9278036</td>
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<td>0,79</td>
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</table>

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

**pads collection and storage**

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

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*Figure 14: Photo of a used under rail pad*

*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
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)
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.

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

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<th></th>
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<tr>
<td>Semelles</td>
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</tr>
<tr>
<td>1 forfait « camion »</td>
<td>1 120€/camion</td>
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<tr>
<td>Estimation à 9,5 tonnes*</td>
<td>250€/tonne</td>
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<tr>
<td>* maximum</td>
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<tr>
<td>0 Acheminement engin de manutention spécifique (chargeur)</td>
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<td>0 forfait d’utilisation camion faible tonnage (type 6x4)</td>
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<td>0,5 forfait journalier d’utilisation du chargeur</td>
<td>1 038,92</td>
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<tr>
<td>TOTAL</td>
<td>4 023,46€</td>
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</table>

Figure 20 : used pad in non hazardous waste skip

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
Conceptualizing the circular economy: An analysis of 114 definitions

Julian Kirchherr*, Denise Reike, Marko Hekker

[Institution name]

Abstract

The circular economy concept has gained momentum both among scholars and practitioners. However, critics claim that it means very different things to different people. This paper provides further evidence for these critics. The aim of this paper is to convey transparency regarding the current understandings of the circular economy concept. For this purpose, we have performed 114 circular economy definitions which were coded on 17 dimensions. Our findings indicate that the circular economy is often, frequently depicted as a combination of reduction, reuse and recycle activities, whereas it is observed that the CE necessitates a systemic shift. We further find that the definitions show low explicit links 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 hardly mentioned. Furthermore, existing business models are often outlined as enablers of the circular economy. We finally discuss the various circular economy conceptualizations throughout this paper, though, 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.
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

This document discusses procurement-level circularity characteristics of a product, focusing on material sources and waste management. It includes a breakdown of materials used, their weight, and their circularity impact. The report is provided by a company and outlines sustainability practices for the procurement of materials.
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
Next step...

Outflow becomes inflow → Close the loop.
Dit bureaublad was eerst een treinplafond van NS
VRAGEN?

Circulair inkopen 19 April 2022
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:

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Destination after use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage reused</td>
<td>Percentage reused</td>
</tr>
<tr>
<td>Percentage recycled</td>
<td>Percentage recycled</td>
</tr>
<tr>
<td>Recycling efficiency</td>
<td>Recycling efficiency</td>
</tr>
<tr>
<td>Lifespan (number of times industry average)</td>
<td></td>
</tr>
<tr>
<td>Functional units (number of times industry average)</td>
<td></td>
</tr>
</tbody>
</table>
Material Circularity Indicator
Dynamic Modelling Tool

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

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Destination after use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reused</td>
<td>&lt;</td>
</tr>
<tr>
<td>Recycled</td>
<td>&lt;</td>
</tr>
<tr>
<td>Recycling efficiency</td>
<td>&lt;</td>
</tr>
<tr>
<td>Lifespan</td>
<td>&lt;</td>
</tr>
<tr>
<td>Functional units</td>
<td>&lt;</td>
</tr>
</tbody>
</table>

#DIV/0!
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

• 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 award model

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

- Carbon-footprint model:
  1. % usage of recycled steel
  2. Energy usage during casting en post-processing
  3. Transport from production location to NS
<table>
<thead>
<tr>
<th>Category</th>
<th>Supplier 1</th>
<th>Supplier 2</th>
<th>Leverancier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycled steel</td>
<td>100%</td>
<td>41% → 405 kg CO₂</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>5 kg CO₂</td>
<td>105 kg CO₂</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>90% train</td>
<td>100% roadtransport</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>15 kg CO₂</td>
<td>100 kg CO₂</td>
<td>n/a</td>
</tr>
<tr>
<td>Totaal</td>
<td>320 kg CO₂</td>
<td>625 kg CO₂</td>
<td>n/a</td>
</tr>
</tbody>
</table>

525.000 KG Co2 reduction
320.000 KG less ‘virgin’ STEEL

-/-160.000 kg Cokes
-/-520.000 kg iron

97,222 pieces
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 resilient 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

- 77 Mt material in stock
- 1.4 Mt annual turnover
- 145 MCHF p.a. material value loss
- 240’000 t CO₂ p.a. from raw material production
Implementing CE measures has an impact on inflow and scope 3 emissions.

- **Inflow**: 240’000 t CO$_2$ eq raw material level
- **Outflow**: 23’700 t CO$_2$ eq waste mgt
- **Stock**: 870’000 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 (logistics, 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
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.
Innovation and Circular Economy is at the heart of our design

- All material (3 million m$^3$) 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

Surface water drainage ponds provide habitat features and cattle watering areas

Terrain modelled to create natural flow paths for water

Chalk grasslands and tree planting promote carbon sequestration

We have designed our landscapes to perform many functions. By working with nature and reusing materials we can create sustainable green infrastructure
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.
Thank you
WABTEC: Rolling stock and circular practices

Edward “Marty” Thomas
Responsible for Global Freight Services Operations,
Group Vice President Freight, Services Wabtec
Remanufacturing Circular-Based Economy

- Design
- Installed Base
- Requalify
- Repair
- Reassemble
- Installed Base

Life Cycle
How many?

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.
Stay in touch with UIC: www.uic.org

#UICrail

Thank you for your attention.