

# Ecodesign in Motion

From Corporate Strategy to project application



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# / Ecodesign in motion

1/ CAF at a glance

2/ Corporate framework

3/ Corporate to Business unit

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5/ Real case application: Double Deck trains for NS

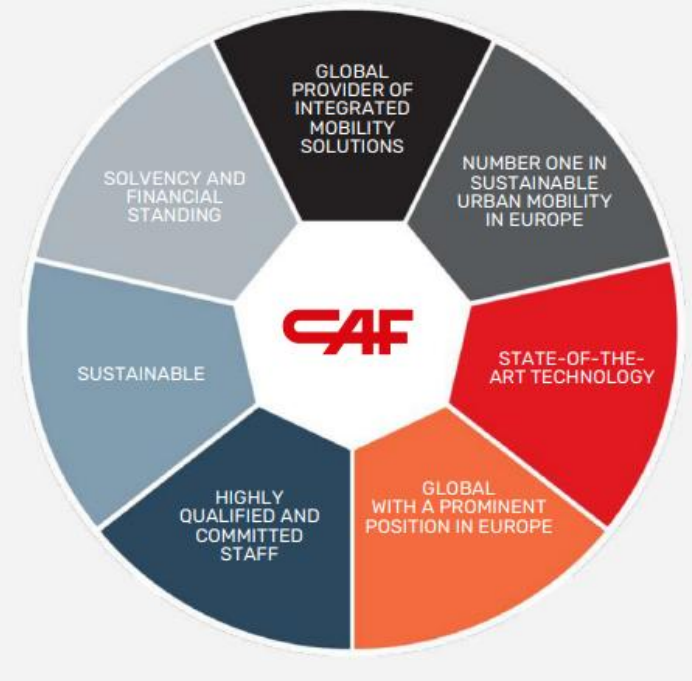
6/ Lessons and next steps

TRUST
IN MOTION

# / Global leader in urban and interurban mobility

International leader in the design and supply of integrated transport systems and a benchmark in the sustainable mobility sector (Rail + bus).

+100 YEARS +60 COUNTRIES +16.000 PEOPLE






# Sustainability as a strategic element

## Corporate commitments guide product decisions

Sustainability was embedded in CAF's Purpose, mission, vision and values as well as it is an axis of the Strategic Plan.

Highets level commitment and monitoring

Sustainability Policy

Strategic Plan:

10 initiatives and 11 targets

Developing an Ecodesign Programme



# How CAF organises ecodesign

## Corporate direction

The CTO approves objectives and indicators.

The corporate ecodesign lead coordinates plans, initiatives and information.

The Ecodesign Committee reviews progress and risks.

## Business-unit deployment

Business management assigns an ecodesign lead.

The business lead deploys guidance, skills and training.

Projects apply requirements with engineering teams and suppliers.

## Three principles of the Ecodesign Policy

| 1 Life-cycle approach | 2 Innovative transport solutions | 3 Culture across the value chain |
|---|---|---|
| Integrate ecodesign throughout the life cycle of products and services, from raw materials to end of life. | Promote innovative solutions that reduce emissions and optimise energy and resource use. | Embed ecodesign across the value chain through collaboration, knowledge sharing and material traceability. |

# Rolling Stock Business Unit - Ecodesign Approach

## Product Life Cycle

### Material use:

- Secondary raw materials
- Low carbon materials
- Minimum material use (weight)
- Use of chemicals

### Product Use:

- Energy efficiency
- Emissions (VOCs, EMC, noise…)
- Durability
- Maintenance

### Value Recovery:

- Upgradability / Modernization
- Disassembly-EoL manuals
- Recyclability

Value chain information - Digitalization (DPP)
Life Cycle Analysis - Environmental Product Declaration (EPDs)
Stakeholder relationship (Ratings, customers, suppliers…)

# NS - CAF: a collaborative ecodesign success story for DDNG

**A fundamental principle of circular economy and ecodesign: approximately 80%** of a product's environmental impact over its life cycle is determined during the initial design and development phase.

## A shared starting point

- NS goal to purchase circularly by 2030
- NS – CAF: Joint journey towards circular trains aligned with both companies policies.
- CAF and NS aligned on circularity requirements and priorities at project kick-off.
- Sharing of lessons learned from different perspectives (sourcing, manufacturing, maintenance, user experience and End of life)

## Collaboration throughout design

- NS and CAF sustainability teams work with engineering from the outset.
- Regular design meetings keep technical decisions aligned.
- Supported by the material passport and design reviews which provide a common evidence base.

# / Key areas of ecodesign implementation

Every alternative must continue to meet safety, reliability and functional requirements as well as quality and cost drivers.

| MATERIALS | CONNECTIONS | MAINTENANCE and END OF LIFE | PROCESSES |
|---|---|---|---|
| **Composition and circularity properties** | **Avoidance of irreversible connections for Separation and repair** | **Frequencies, spare parts and EoL instructions** | **Inspection and protective materials** |



# / The material passport supports design decisions

**World's first rail vehicle with a material passport**.

| Passport information | Design question |
|---|---|
| Mass and composition | Which materials dominate the product? |
| Recycled content | Where can virgin inputs decrease? |
| Irreversible connections | What prevents separation or repair? |
| Recyclability | How can each material recover value? |

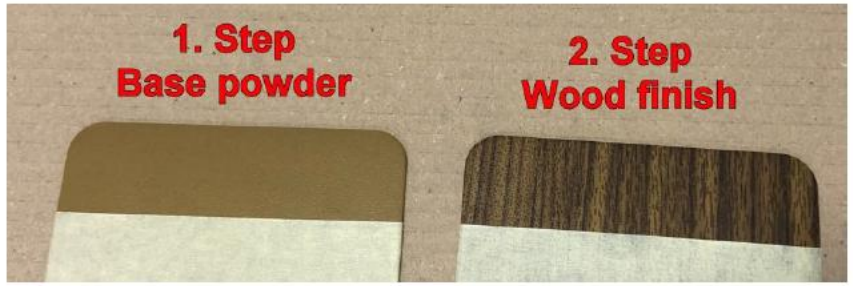
## A living design record

Update it as supplier data and the design mature.

Use it to identify opportunities and support circularity calculations.

# / Material and connection choices improve circularity

| DDNG design choice | Circularity rationale |
|---|---|
| Floor boards: **Aluminium honeycomb** vs composite solution | Material recovery and separation |
| Reduction of adhesive unions by **bolted** solutions | Disassembly during maintenance or EoL |
| **Interiors**: Sublimated aluminium linings replace HPL or GRP (rethink on the shape) | A more recyclable material route |
| **Flooring:** Double sided taped rubber replaces first-class carpet | Avoid a non-recyclable floor covering and easier disassembly |
| Fewer irreversible **air-duct** joints | Easier separation at end of life |



# / Design for maintenance and end-of-life disassembly

## Longer intervals where technically justified

| Example | Reference | DDNG |
|---|---|---|
| Damper maintenance | 1.2 million km | 2.8 million km |
| Bioreactor overhaul | 8 years | 10 years |

Corrective maintenance where appropriate

Common parts and fewer spare references

Increase the elements made by Additive manufacturing to reduce the number of spares and optimize the design and shape

Accessible fixings and equipment dismantling instructions




Seat concept: modular design with replaceable components and reduced number of references

# Manufacturing and inspection choices reduce material use

## Manufacturing improvements

Reusable metal frames protect windows during painting.

They replace paper and cardboard protections used for this operation.

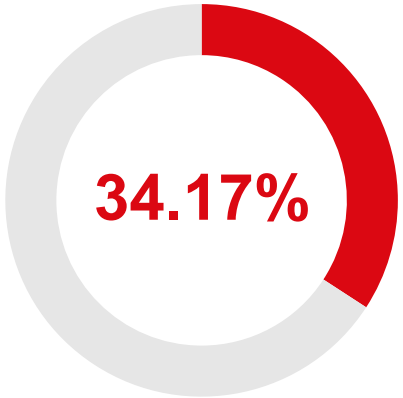
## Opportunity with the customer

Align inspection stages with NS so protective floor coverings can remain in place.

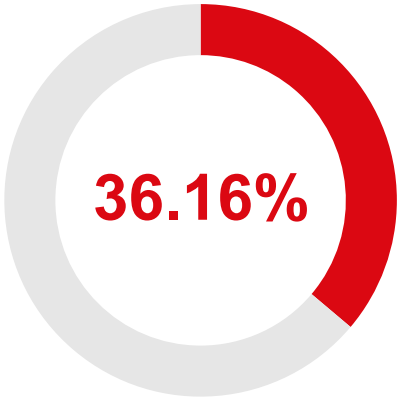
Avoid repeated removal and replacement where inspection requirements allow.

# Recycled content and lower-emission materials

## More than 30% recycled input




DDNG-4




DDNG-6

Estimated share of total train mass, based on available supplier information.

## Supplier choices matter

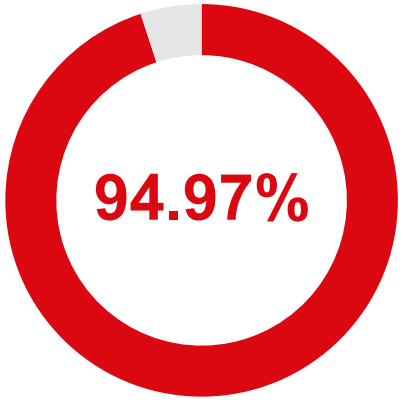
For wheels and axles, the agreed steel ingot input uses 100% metal scrap.

More than 60% of recycled content in the Aluminium carbody

Future evaluation: lower-emission steel in critical components, subject to qualification and verified environmental evidence.

# Circular outflow

## More than 94% of recyclability



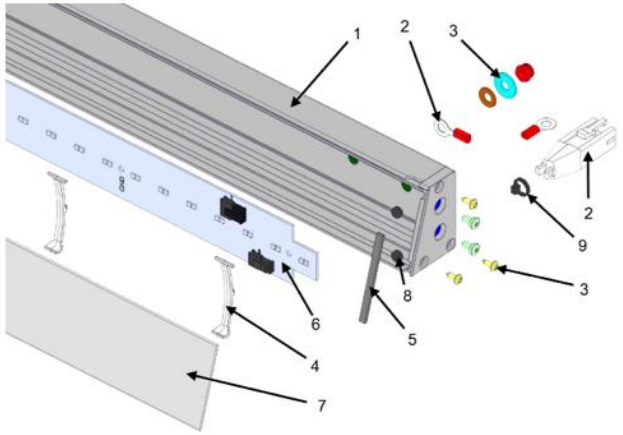

DDNG-4




DDNG-6

Estimated recyclability values based on ISO 21106 calculation

## End of Life instructions




Individual dismantling instructions for elements for optimal recycling

# / Lessons from NS DDNG

| COLLABORATION | INFORMATION | PRODUCT LIFE | DEPLOYMENT |
|---|---|---|---|
| **Customer alignment from kick-off** | **Traceable supplier and design data** | **Repair and dismantling by design** | **Reuse effective practices across projects** |