

# CIRCULARITY IN THE DUTCH TRAIN

Designing a sustainable alternative to the interior sidewall panel

## The context

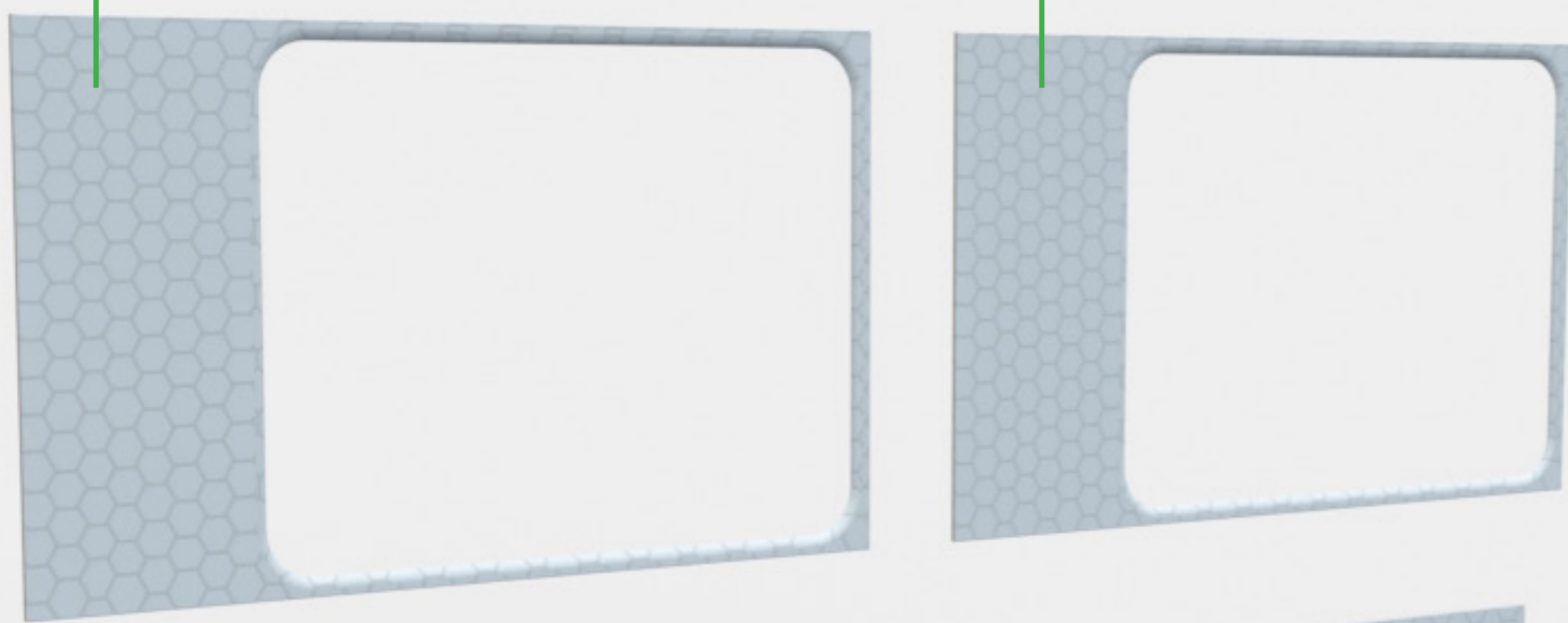
The vision of NS is to provide 'Sustainable accessibility within the Netherlands. For everyone'. Part of this mission includes making the transition towards fully circular trains in 2030. This means a large share of the trains will have to be processed in a circular manner during the modernisation and dismantling, and that new trains will have to be designed in a circular manner. This is a big challenge, as a train is a very big and complex product, bound by a wide range of very strict operational and safety regulations. This led to the following research question:

*"How can NS achieve circular inflow and outflow during building, modernisation and end-of-life for the train interior, car body and bogies?"*

Through multiple analyses and explorative design, the train interior side wall panel was selected as design concept. The current side wall panel is made of glass fibre polyester composite, which is difficult to reuse or repurpose, and cannot be recycled. A sustainable alternative was developed which uses recyclable aluminium honeycomb materials, and has a dismantlable structure due to the use of reversible Niaga adhesive. The flat shape of the panel and optimized surface distribution increase the available panel size, which increases the potential for reuse or repurpose. Additionally, the wall panel is finished through the use of coloured foil instead of paint as this reduces toxic substances and improves cleanability, readjustability and recyclability. It also gives additional customization options to the panel, such as integrating a honeycomb pattern to illustrate the circular construction.

Window shifted off-centre to increase reusable surface

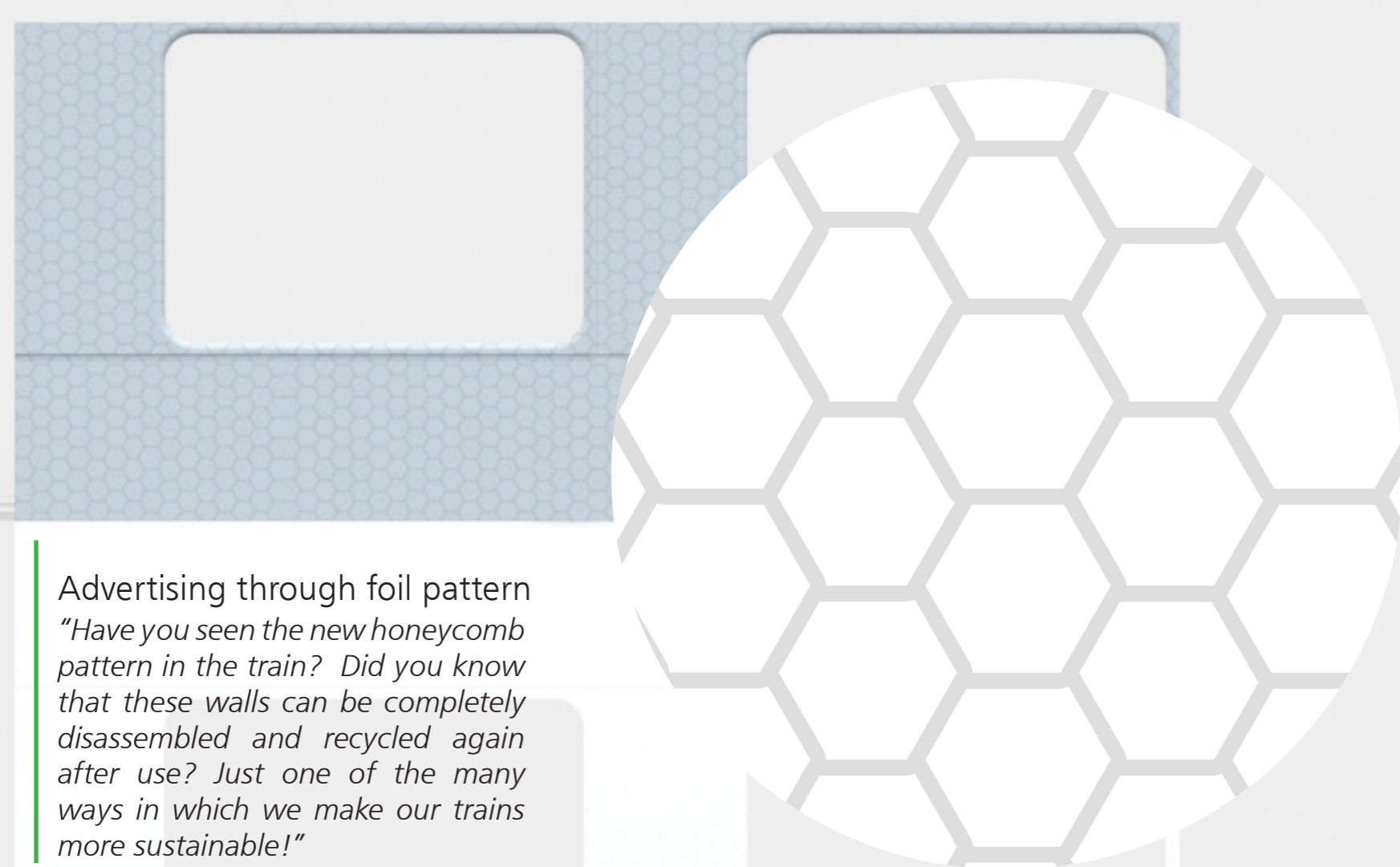
Only window frame needs replacement when window shape changes



Flat shape is easier to reuse, reshape and/or repurpose

Larger separate bottom section for improved reusability

Reversible material construction and recognizable pattern



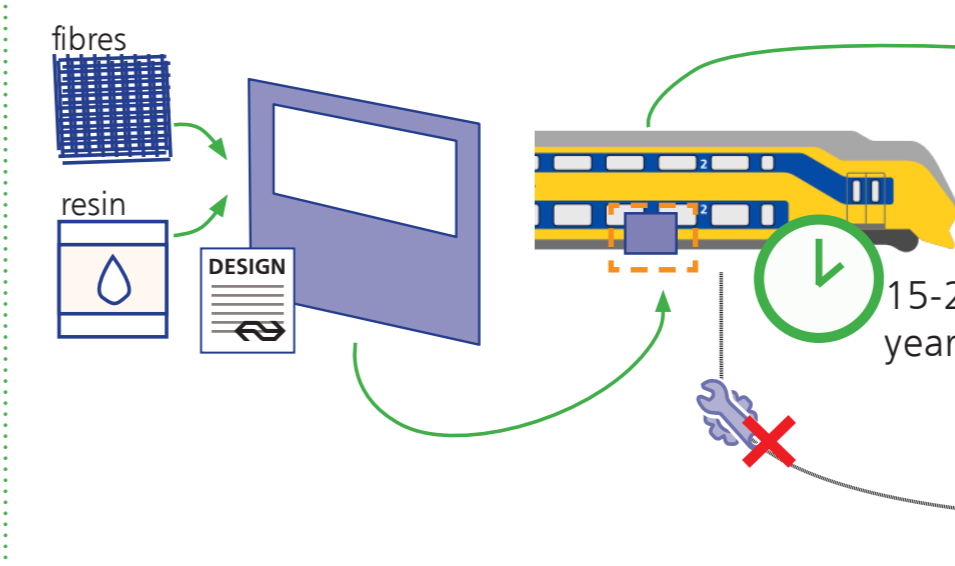
Advertising through foil pattern  
"Have you seen the new honeycomb pattern in the train? Did you know that these walls can be completely disassembled and recycled again after use? Just one of the many ways in which we make our trains more sustainable!"

A. A. van Oudheusden  
Circularity in the Dutch train  
31-8-2020  
Integrated Product Design

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**Company** Nederlandse Spoorwegen

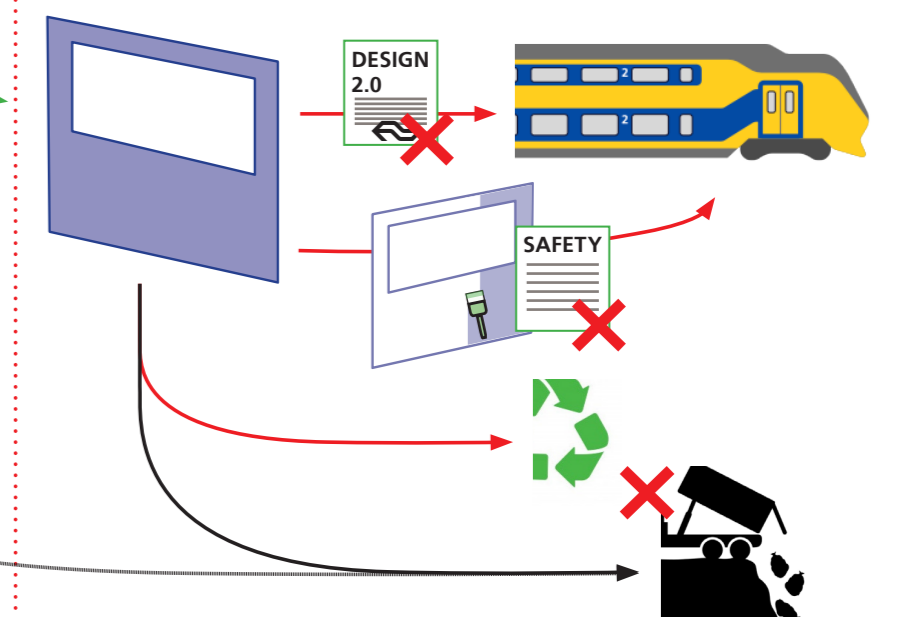
## The problem

The current sidewall panels are specifically designed for NS, made from a sturdy composite material. The panels are used in the train for 15-20 years until modernisation, but they could easily last longer. The panel cannot be readjusted for repair or a design change.



- + LONG PRODUCT LIFETIME
- + RESIDUAL VALUE IN MATERIAL AFTER FIRST
- DIFFICULT TO REPAIR OR RECONFIGURE

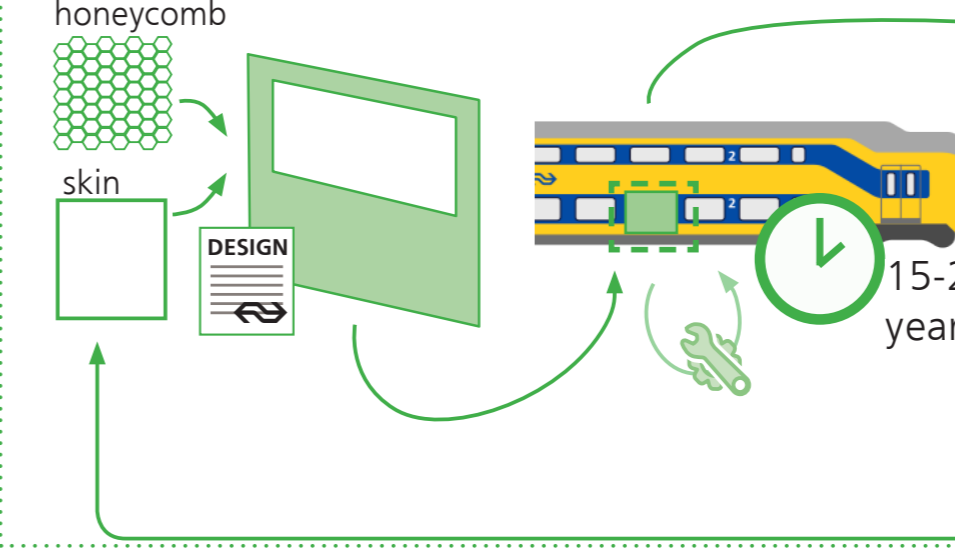
If the old panels do not match with the modernized train interior, it is not possible to alter them due to tightened safety regulations. As the material cannot be recycled, it ends up in landfill.



- DIFFICULT TO REUSE, RECONFIGURE OR REPURPOSE
- MATERIAL IS NON-RECYCLABLE

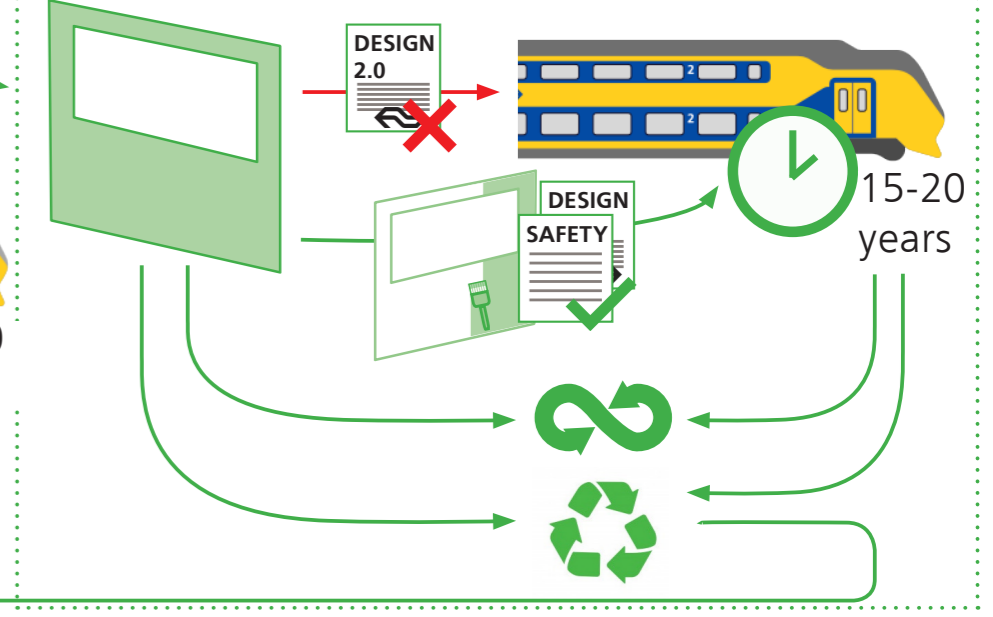
## The solution

The sustainable sidewall panels are specifically designed for NS, made from a sturdy honeycomb material. The panels are used in the train for 15-20 years until modernisation, but they could easily last longer. The panels can be repaired or reconfigured.



- + LONG PRODUCT LIFETIME
- + RESIDUAL VALUE IN MATERIAL AFTER FIRST USE
- + MATERIAL CAN BE REPAIRED OR RECONFIGURED

If the old panels do not match with the modernized train interior, it is possible to reconfigure them and also meet the new regulations. Repurpose outside the train is also more feasible, and at the end-of-life the material can be recycled.



- + EASIER TO REUSE, RECONFIGURE OR REPURPOSE
- + MATERIAL IS RECYCLABLE

Recyclable foil with recognizable pattern

Recyclable and highly fire-resistant aluminium skin

Reversible Niaga adhesive

Recyclable and highly fire-resistant aluminium honeycomb core

