

## Innovative, very light and strong, composite train nose

### ***Purpose of the project***

For the 25 year old Intercity trains from the Dutch Railway's the time was there to get to be refurbished. The 285 trains used to have a back and front nose with two doors through which the passengers could move from one part to the other during driving of the train. The doors however were failing more and more when coupling trains and passengers did not like to go through the narrow corridor when moving from one part to the other. So decided was that the two steel doors had to be replaced. But by what? Together with the engineering department of NedTrain (Dutch Railways) NPSP Composites developed a high quality, reliable, very light double bended sandwich composite front and back panel that fulfilled all technical requirements and saved a lot of energy by being so light. The development was done within a tight deadline.



*{picture 1: the 25 year old ICM train}*

### ***How it was organized***

NedTrain engineering department took the initiative to re-engineer the front plate and to step over to the new innovative composite material. Together with the dedicated NPSP team the new front panels were developed. Strength, stiffness and impact resistance were being optimized next to that fire resistance. Before production started the elements have been tested extensively in Austria.

DSM Resins advised on which resin should be used to fulfill the physical; properties in combination with the VA-RTM production process.

Airborne composites helped with the engineering part.

3M developed the special foil which has been used in stead of the environmentally unfriendly spray painting methods.

The Dutch Ministry of Economic Affairs has

sponsored the development through their Agentschap NL agency.



*{picture 2: the newly developed ICM train}*

### ***Physical Task of the project***

The new nose plates were made using glass fibre and foam, making them lighter and cheaper than the old steel noses. The design and production technique has lowered installation costs, energy use, CO<sub>2</sub> emissions and maintenance. The attachment points were incorporated at the moulding stage to guarantee the tolerances on the connections. As well as being strong and rigid, the new nose plates can withstand all weather conditions. It was possible to produce several plates at one time, using several moulds.

Sandwich of foam between layers of glass fibre and resin; double mould, one-shot production

NPSP produces the panels with the innovative Vacuum Assisted-Resin Transfer Moulding production process that next to a higher precision and higher quality also results in a much (95%) lower exhaust of styrene gasses. This production technique also gives the opportunity to integrate metal inserts in the one shot production step.

The size of the panel is 2 meter times 1,5 meter with a thickness of 80 mm.

### ***Results and impact on the sustainability performance of rail***

At this moment 150 of the 285 trains have been applied with the new innovative front and back panels. The new front and back panels for the Intercity train of the Dutch Railway's has a number of sustainability advantages.

1. Because the lower weight of the panels (1000 kg per train) the use of electricity is lower. Dutch Railways have calculated that per kg lighter a train is the train uses 5 kWh less energy per year. This means per train a saving of 5 MWh on electricity and therefore 500 euro on electricity costs per year.
2. 1 kWh of electricity is comparable to an exhaust of 0,5 kg CO<sub>2</sub>. This means that each train is 0,5 tonnes of CO<sub>2</sub> less pollutant per year.
3. Use of energy friendly VA-RTM production technique.
4. In stead of being spray painted, with a high exhaust of gasses, NedTrain decided to step over to innovative 3M foils.
5. A next step, of which already a prototype has been made, is the change from glass fibre reinforced composite material towards natural fiber reinforced composite materials. Of this a demonstrative prototype has been unveiled by the Dutch Minister of Environment.

### ***How success of the project was or will be measured***

The weight reduction has been measured by measuring the old metal parts (570 kg) and measuring the new sandwich panels (60 kg per piece). The calculation of the 5 kWh energy saving per year per kg lighter has been done on basis of energy measurements by NedTrain engineering department.

Next to the environmental success there was also a publicity success as the results have been published in several professional media. This raises awareness by the public for environmentally friendly train transport.

### ***Why you believe this paper should be awarded***

1. An environmental innovation that is really being realized in trains (at this moment 150 of 285 trains in total have been implemented with the new panels;
2. Innovative use of sandwich composites in refurbishment of trains;
3. Use of energy friendly and styrene free production method;
4. A very visible product which is being seen by millions of passengers every day;
5. A prototype of a front panel could be taken to the Sustainability Conference to show to all participants;
6. National and International attention to this innovation (a.o. Rail industry news, [www.iorw.org/news\\_index.html](http://www.iorw.org/news_index.html));

Attached are photo's of the production process, the material set up and the Dutch Minister of Environment in front of the natural fibres and balsa wood prototype. And an international press release by DSM.

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