

Environmental benefits of the high strength steel tipping trailer

Did you know that...

- Upgrading the steel in a bulk tipping trailer to high strength steel resulted in the trailer's carrying capacity being increased by 1.3 tonnes.
- Emissions of greenhouse gases thereby declined by 5-6 % over the trailer's lifetime.

The world needs Swedish steel

Steel is the world's most widely used metallic construction material thanks to the material's strength in relation to its weight and price. During 2013 almost 1.6 billion tonnes of steel were produced globally.¹ Sweden's steel industry makes up about half a per cent of the world production. However, Swedish steel companies are highly specialised. In many cases they are world leaders within their respective niches.²

Steel forms part of an eco-cycle and can be recycled endlessly as raw material for new steel without any deterioration in quality. This makes it unique amongst modern materials.

New, advanced steel grades are being developed all the time. Many of the steel grades that Swedish steel companies produce today were not even on the market five years ago.²

High strength steel is stronger than conventional

steel and makes it possible to produce lighter steel designs. A doubling in the strength delivers a weight reduction of about 30 % of the upgraded structural components.³ Upgrading means replacing with a steel of higher yield strength. Lighter structures lead to lower environmental impact through reduced emissions, more energy-efficient products and the sustainable use of natural resources.

Case study

For vehicles that transport heavy freight, for example metals and scrap, a weight reduction frequently means that the vehicle's load capacity increases. Greater load capacity entails fewer transport journeys to carry a certain quantity of goods. This, in turn, means more efficient transport journeys and reduced environmental impact.

In a case study³, through life cycle assessments, the environmental benefit of upgrading steel in a tipping trailer to high strength steel was investigated. The bulk tipping trailer is used mainly for transporting steel scrap and steel coils to and from steel plants. The steel in the trailer's frame and loading platform is upgraded from steel with yield strengths between 355 MPa and 1000 MPa to steel with yield strengths between 700 MPa and 1200 MPa.

¹ World Steel Association

² Jernkontoret, *Steel shapes a better future*

³ The Steel Eco-Cycle, *Environmental research Programme D 853.*



The life cycle assessments include the environmental impact from the steel production, the transportation of the steel as well as the use of the tipping trailer. The average load factor of the trailer is assumed to be 85 % and its useful life is estimated at 6 years.

Results

The trailer's total kerb weight could be reduced by 1.3 tonnes through upgrading. This is equivalent to a weight reduction of 30 % for the upgraded parts. The weight reduction enables an increase in the trailer's load capacity from 27 tonnes to 28.3 tonnes or about 5 %.

Before the upgrading, some 400 journeys a year were made with the scrap container, an average of 250 km/ journey. To transport the same amount of load after the upgrading, only 382 journeys a year were needed. The fuel consumption, when the trailer runs unloaded, is cut by 0.01 litre/km after the upgrade.

During the useful life of the trailer, the greenhouse gas emissions were cut by about 30 000 kg CO_{2e} through upgrading to high strength steel. This is equivalent to a cut of 5-6 % in the total emissions.

Weight reduction, reduced emissions and reduced energy use on upgrading to higher strength steel.

Weight reduction (ton)	Weight reduction with upgraded parts (%)	Reduced greenhouse gas emissions (kg CO _{2e})	Reduced Energy use (kWh)
1,3	30	30 000	120 500

The major part of the reduction in emissions, 90 %, arises as a consequence of lower fuel consumption during the use of the trailer. The remaining cut in emissions is due to the need to produce a lesser amount of steel to manufacture the lighter, upgraded trailer.

The use of high strength steel also means that the useful life of the upgraded parts increases also. This, however, has

not been included in the calculations since it is assumed to have only a minor effect on the total results.

Apart from reduced environmental impact, the upgrading results in lower costs also. The steel price per unit weight is slightly higher for the high strength steel than for the conventional steels.

However, the costs of production and use of the trailer are lower for the upgraded trailer. In total, the life cycle costs are about 10 % lower for the upgraded trailer.

Conclusion

To produce lighter trucks with high strength steel leads to more efficient transportation and reduced environmental impact.

During 2012 the greenhouse gas emissions from heavy trucks were 4.3 million tonnes in Sweden.⁴ A cut in emissions by 5 %, as in the case of the tipping trailer, corresponds to a reduction of about 216 000 tonnes CO_{2e}. This is roughly equivalent to the emissions of 90 000 private cars each year in Sweden.^{4,5}

Swedish steel and the companies' knowledge of its applications create opportunities for producing more efficient designs which reduce the environmental impact when the products are used. The choice of high strength steel for vehicles is one example of this potential.

This shows the importance of paying attention to the environmental impact from the steel product's entire life cycle, and not only examine the environmental impact from the production of the steel. In general terms, over 90 % of the environmental impact from the transport sector occurs during use of the vehicle, in the form of carbon dioxide emissions and other pollutants.

The properties of steel in terms of high strength, long operating life and recyclability make the material a significant component of sustainable development.

⁴ Swedish Environmental Protection Agency. www.swedishepa.se

⁵ Transport Analysis. www.trafa.se

Do you wish to know more? Please contact us at Jernkontoret.

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