Enviromental benefits

Environmental benefits of high strength steel in timber trailers

Did you know...?

- Through upgrading the steel in a timber trailer, the load capacity increases by 500 kg and greenhouse gas emissions decrease by 25 tonnes CO_{2e} over the vehicle's lifetime.
- In the Swedish vehicle fleet of timber trailers, the use of high strength steel can reduce annual greenhouse gas emissions by 50 000 tonnes CO_{2e}. This is equivalent to the annual emissions from 20 000 private cars in Sweden.

The world needs Swedish steel

Steel is the most widely used metallic construction material in the world, thanks to its strength in relation to weight and price. In 2013 almost 1.6 billion tonnes of steel were produced globally[1]. The Swedish 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 among 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 % in the upgraded structural components[3]. Lighter structures lead to environmental impact through lower emissions, more energy-efficient products and the conservation of natural resources.

Case study

Logistics is an important aspect of forestry since large volumes of raw material must be transported in an efficient way. Truck transport accounts for a large part of timber transportation in Sweden. Through using high strength steel in trucks it is possible to produce lighter and more fuel-efficient vehicles and the load capacity of these vehicles frequently increases also.

In a case study[3], through a life cycle analysis, an estimate has been made of the difference in environmental impact between a timber transport vehicle where the frame of the trailer is manufactured

[1] *World Steel Association*
[2] *Jernkontoret, Steel shapes a better future*
[3] *The Steel Eco-Cycle, Environmental Research Programme D 853.*

STEEL SHAPES A BETTER FUTURE

of advanced, high strength steel and one of conventional steel respectively. The lengthwise beams on the timber trailer are upgraded from steel with a yield strength of 310 MPa to steel with a yield strength of 700 MPa.

The life cycle assessments include the environmental impact from the production and transportation of the steel in the beams, the impact from the use of the timber vehicle as well as the recycling of the steel.

The vehicle's useful life is assumed to be seven years and the average driving distance 175 000 km yearly. Half of the transport journeys are estimated to take place with full load and the transport journeys are thus weight critical. For weight critical transportation, a weight reduction implies that the vehicle load capacity increases. Since the load capacity increases, fewer journeys are required to transport a certain quantity of goods.

Results

The beams of high strength steel are 350 kg lighter than the beams of conventional steel. This corresponds to a weight reduction of 37 % of the upgraded parts. The total weight of the timber trailer could be reduced by an additional 150 kg through changes in design and the weight reduction in other parts of the chassis. Through the weight reduction, the trailer's load capacity could increase by 500 kg, from 30 230 to 30 730 kg. The timber trailer's maximum gross weight is 36 tonnes.

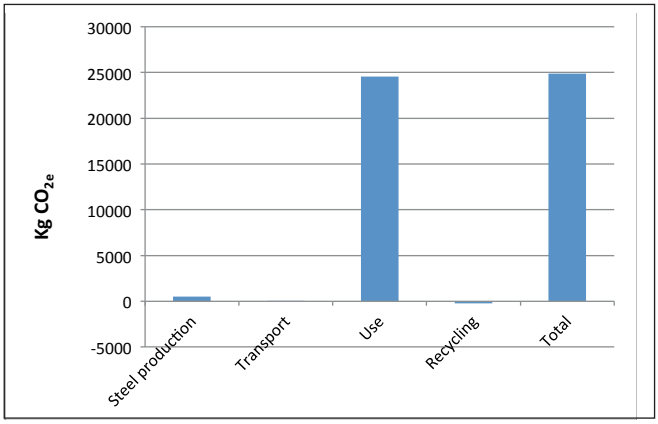
Greenhouse gas emissions from the steel production, transportation, use of the timber vehicle and recycling are 25 tonnes CO_{2e} lower when the trailer is made of high strength steel compared with conventional steel. The use of non-renewable energy is 100 MWh lower.

Weight reduction, reduced greenhouse gas emissions and reduced energy use for an upgraded timber trailer.

Weight reduction (kg)	Weight reduction upgraded parts (%)	Ruduced emissions (kg CO_{2e})	Reduced energy use (MWh)
500	37	25 000	100

As much as 99 % of the emission reduction arises during the use of the timber vehicle as a consequence of reduced fuel consumption. A small part of the decrease in emissions is due to lower amounts of steel needed to be produced and transported to manufacture the lighter timber trailer of high strength steel.

The difference in the vehicle's environmental impact decreases when the scrap that can be recycled is taken into account. This is due to the possibility of recycling a greater quantity of steel from the heavier trailer compared with the lighter, upgraded one.



Reduced emissions of greenhouse gases for a timber vehicle with trailer of high strength steel compared with one where the trailer is made of conventional steel.

Besides lower environmental impact, the upgrading to high strength steel leads to fuel costs being reduced by about SEK 123 000 during its lifetime. This is calculated on the basis of a fuel cost of SEK 15/litre. The costs of manufacturing the timber trailer in high strength steel and conventional steel respectively are more or less the same.

Conclusion

The use of high strength steel has the potential to greatly reduce the greenhouse emissions from timber transportation in Sweden. Further calculations show that by upgrading the steel in the Swedish timber vehicle fleet (about 2 000 vehicles) greenhouse gas emissions can be reduced by about 50 000 tonnes CO_{2e}. This is roughly equivalent to the annual emissions of 20 000 private cars in Sweden[4, 5]. The upgrade would also mean that the consumption of non-renewable energy will be reduced by 200 GWh and the costs of fuel by SEK 250 million, over the vehicle's lifetime.

Swedish steel and the companies' knowledge of its applications create possibilities for producing more efficient structures that reduce the environmental impact when the products are used. The case of high strength steel in road vehicles is one example of this potential.

This shows the importance of paying attention to the environmental impact during the entire life cycle of the steel product,and not only examine the environmental impact from the production of the steel itself.

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

[4] *Swedish Environmental Protection Agency*
[5] *Transport Analysis*

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