

Environmental benefits of high strength steel in cranes

Did you know that...

- Through upgrading the steel in a crane arm to high strength steel, greenhouse gas emissions could be cut by 4.7 tonnes CO_{2e}.
- If the corresponding upgrade were carried out on 4,000 cranes, the greenhouse gas emissions could be cut by 68 000 tonnes CO_{2e}. This is roughly equivalent to the annual emissions of 28 000 private cars in Sweden.

The world needs Swedish steel

Steel is the world's most 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 enables the production of lighter steel designs. A doubling in the strength delivers a weight reduction of about 30 % in the upgraded structural parts.³ Upgrading means replacing with a steel with 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

To use advanced, high strength steel in a truck-mounted crane arm is an effective way of cutting the crane arm's weight and thereby increasing the system's load capacity. The weight of the truck where the crane is mounted is also reduced through upgrading of the steel. This leads to increased transport capacity and thereby reduced environmental impact.

In a case study³, the environmental benefit is estimated of using high strength steel in a crane arm when the crane operates on a truck bed. The steel in the crane arm extension (telescopic boom) and the steel in the stabilisers (outriggers) are upgraded. The outriggers are used to stop the truck toppling over when the crane is in operation. On average, the steel's yield strength increases from 737 MPa to 1040 MPa.

The environmental benefit of upgrading the steel in the crane arm has been quantified through life cycle assessments. In these assessments are included the environmental impact from the steel

¹ World Steel Association

² Jernkontoret, *Steel shapes a better future*

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



production, the transportation of the steel, the operations of the truck as well as the recycling of the steel.

Half of the transport journeys carried out by the truck crane are assumed to take place with a full load and are thus weight-critical. The truck is assumed to cover, on average, a distance of 1 200 000 km over its lifetime.

Results

The upgrade to high strength steel in the crane arm extension, and in the stabilisers, enables a weight reduction in the upgraded parts of 114 kg. This corresponds to an overall weight reduction of 17 %.

For the weight-critical transport journeys the weight reduction results in an increase in the truck's transportation capacity. This implies that fewer journeys are required to transport the same quantity of goods. For other transport journeys, the weight reduction means that there is a decrease in the truck's fuel consumption.

The greenhouse gas emissions from the steel production, the use of the vehicle and the recycling of the steel are cut by a total of 4 650 kg CO_{2e} through the upgrade to high strength steel. Meanwhile, the use of non-renewable energy declines by 18 600 kWh.

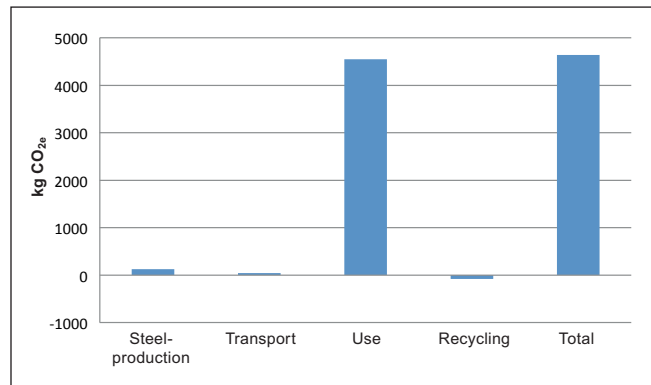
Weight reduction, reduced emissions and lower energy consumption for a crane arm of high strength steel compared with conventional steel.

Weight reduction (ton)	Weight reduction with upgraded parts (%)	Reduced greenhouse gas emissions (kg CO _{2e})	Reduced Energy use (kWh)
114	17	4 650	18 600

The major part of the emission reduction, 99 %, arises during use of the vehicle owing to lower fuel consumption. The remaining emission reduction is due to the need to produce and transport smaller quantities of steel for the upgraded structure.

The difference in the crane'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 crane compared with the lighter, upgraded one.

Besides the reduced environmental impact, the upgrade



Reduced greenhouse gas emissions for vehicles with crane arms made of high strength steel compared with conventional steel.

also leads to cost savings as a consequence of lower fuel consumption. The total costs for the truck crane during its life cycle are cut by about SEK 22 000, calculated on the basis of a fuel cost of SEK 15/litre.

Conclusion

Further calculations, on the basis of the study results, show that through replacing conventional steel by high strength steel in truck cranes the greenhouse gas emissions during the cranes' lifetimes are cut by 68 000 tonnes CO_{2e}. This is roughly equivalent to the annual emissions of 28 000 private cars in Sweden.^{4,5} The energy use of the cranes would be cut by 268 GWh and consequently the vehicles' fuel costs by about SEK 320 million.

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

This shows the importance of paying attention to the environmental impact during the steel product's entire life cycle, 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 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.

Telephone +46 8 679 17 00 | E-mail office@jernkontoret.se | www.jernkontoret.se

JERNKONTORET

THE SWEDISH STEEL
PRODUCERS' ASSOCIATION

