Steel has a sustainability message to tell!

In order to assist engineers and specifiers to understand these messages and the sustainability credentials of steel, we've compiled a quick reference list of frequently asked questions.

HERA

In response to our role in reducing Aotearoa New Zealand's carbon emissions – we're in the process of developing the world's first comprehensive steel product offset calculator.

Is there such thing as zero carbon steel?

Yes, HERA has launched a zero carbon steel program that uses carbon offsetting for steel used in New Zealand. This is a world first program of its type and was developed independently by thinkstepANZ.

It covers a range of steel products including heavy structural steel, light gauge structural steel, roofing and cladding, reinforcing, and stainless steel. Specifiers can specify carbon steel and the steel fabricator/rollformer can use the program to offset any associated carbon.

Offsetting does incur an additional cost. This may add in the vicinity of 5 – 10% to the cost of the fabricated steel but is still likely to be lower cost than a comparable timber option.

Why should I not focus just on embodied carbon?

If our aim is to reduce net carbon emissions, we have to stop focusing on embodied carbon and focus on lifecycle carbon emissions.

Embodied carbon only considers carbon at the point in time that a building is built. Lifecycle carbon also considers carbon that is emitted during operations and at the end-of-life of a building.

If we don't consider life cycle carbon, we are deferring the carbon problem for future generations. For example, much of the conversation around carbon in timber versus steel focuses on timber's ability to store carbon. However, at the end-of-life of a building, timber releases that carbon back into the atmosphere. For this reason, embodied carbon assessments favour timber but life cycle carbon assessments give a more accurate view of the true carbon impacts.

Conversely, the high recycling rates of steel mean that it has multiple lives and there is a carbon benefit that is passed on through recycling. In HERA's Recycling Report, this carbon benefit was calculated to be about 1,249 kg CO_2-equivalent per tonne of scrap.

What is steel's role in the circular economy?

Building and construction has very high levels of waste and follows a linear model. Transitioning to a circular economy requires greater material efficiency, reuse and recycling. Steel is already a core part of the circular economy due to its high recycling rates, long lifetimes, resilience (especially in Aotearoa's seismic environments) and ability for re-use.

On the other hand, timber doesn't play a key role in the circular economy because recycling and downcycling is problematic for timber due to toxicity issues. This was identified in the ECAN Report No. R13/31, which stated: "The next most 'simple' form of recycling is the use of treated timber as a mulch or compost. The propensity for such products to leach arsenic at a relatively high rate due to their increased surface area quickly render them unfeasible as a useful outlet for waste treated timber."

It was also explored in the Rhodes and Dolan (2013) paper: "Products such as particleboard, chipboard and oriented strand board (OSB) can theoretically be made with treated timber. However, there are drawbacks.

Europe and the UK have contamination standards for the production of particleboard (and similar products) that limit the percentage of CCA treated timber that could be used in particleboard production to less than 1 percent. In New Zealand, 1 % of the total fibreboard and particleboard production in 2006 was 11,170 m3".

Researchers at Lincoln university recently conducted an experimental case study to investigate how treated timbers, ashes, and other contamination can impact arsenic concentration in compost production (Safa et. al 2020). The results showed that: "most treated timbers and all ashes of treated and untreated timbers contained significant amounts of arsenic" (Safa et. al 2020).

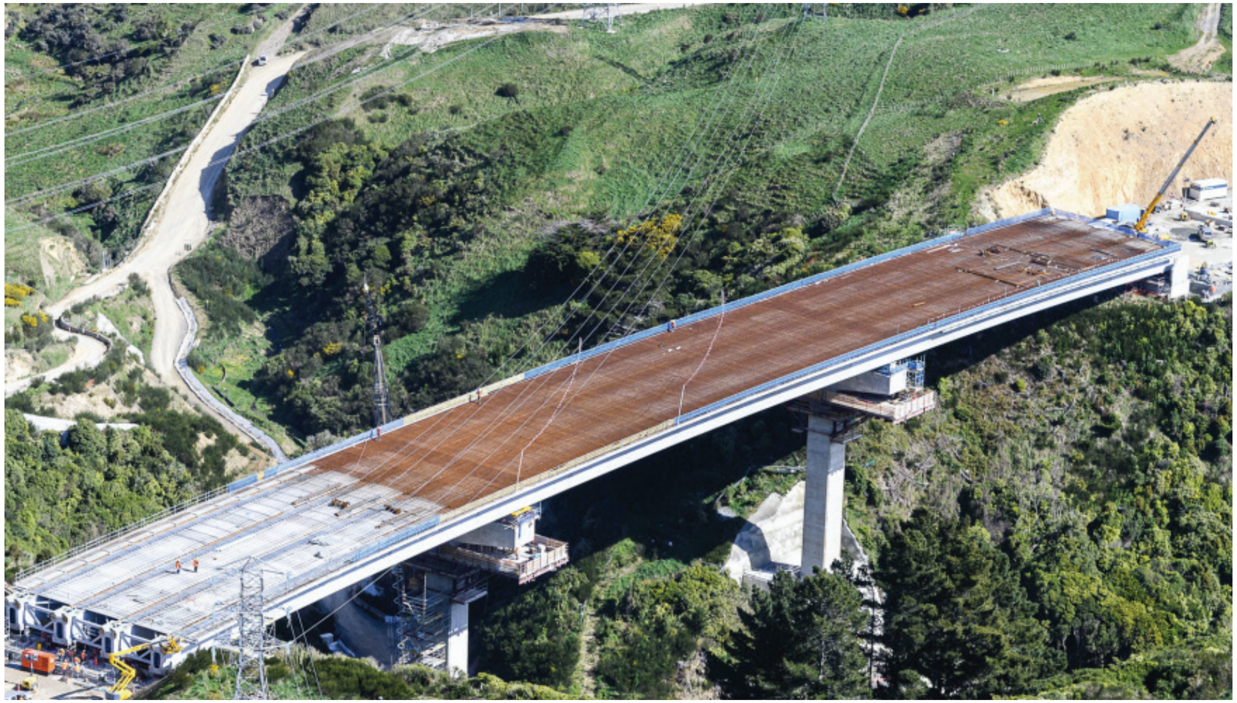
On top of this, the NZ Herald recently reported that "according to the Ministry of Environment around 400,000 tonnes of noxious waste is being dumped in the nation's landfills annually due to New Zealand's ongoing use of toxic agents in treated timber due to its inability to be recyclable" (Toxic treated timber).

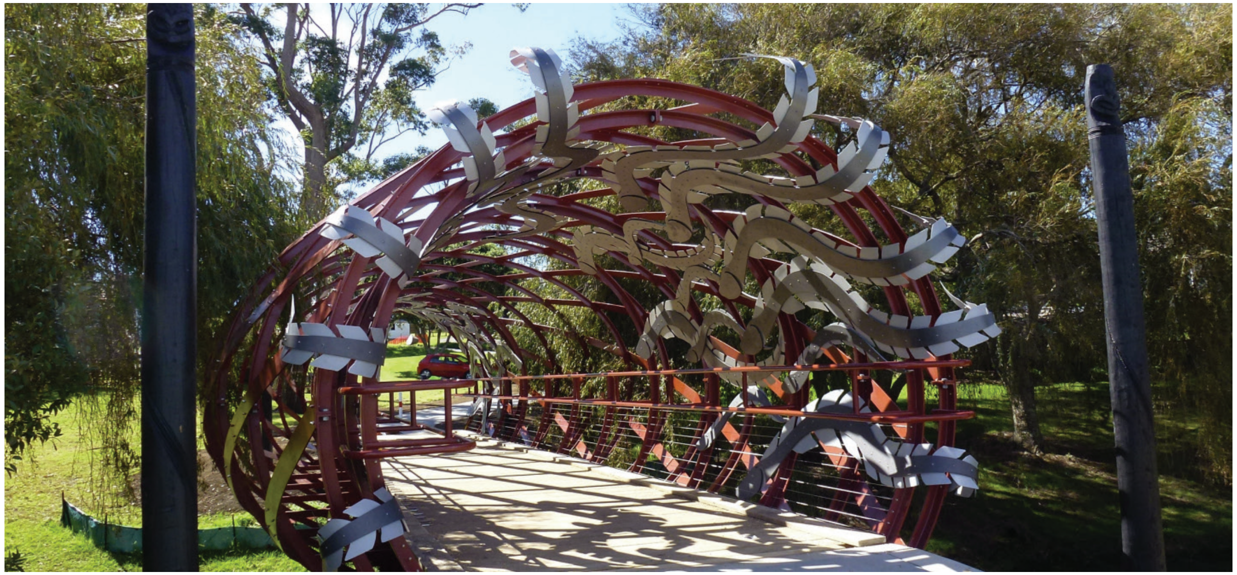
Should I specify recycled steel?

Globally, steel is amongst the top recycled building materials.

Specifying recycled content is a good driver to encourage a market for recycled materials that are otherwise going to landfilll. This is not the case for steel, which is highly recycled.

HERA recently commissioned thinkstepANZ to estimate recycling rates of steel used in New Zealand. They estimated that 72% of all steel used in New Zealand is recycled. This rate would be much higher for structural steel as the average is lowered due to New Zealand's lower recycling rates of consumer goods steel. Therefore, specifying steel with a high recycled content doesn't drive net carbon reductions as globally steel is already highly recycled. Using local steel, even if it has a lower recycled content, has the benefit of reducing carbon associated with freight from the supply chain.





Why is steel not recycled in NZ?

Steel made in New Zealand uses a unique steel making process that enables use of New Zealand raw material – its iron sands. It doesn't utilise post consumer steel scrap.

However, 85% of building and construction steel scrap in New Zealand is collected for recycling by a thriving steel recycling industry. This is sent offshore for processing. In HERA's Recycling Report, the carbon benefit of doing so was calculated to be about 1,249 kg CO2-equivalent per tonne of scrap.

It should be noted that global demand for steel far exceeds global steel scrap levels so it isn't possible to make all steel from recycled steel scrap.

In 2023, New Zealand Steel announced plans to develop an Electric Arc Furnace. This will enable local re-use of steel scrap for steel production.

Why is some imported steel lower carbon than steel produced in New Zealand?

Steel made in New Zealand uses a unique steel making process that enables use of New Zealand raw material, its iron sands. In addition, New Zealand's production output is very small by global standards.

Globally, around 70% of steel is made by primary basic oxygen steel-making process (BF-BOF) and the rest is predominantly via the secondary electric arc furnace process (EAF). The EAF route uses mostly post consumer steel scrap content and therefore has a carbon footprint 20% of that of BF-BOF.

In addition, carbon efficiencies come from greater volumes of production. It should be noted that global demand for steel far exceeds global steel scrap levels so it isn't possible to make all steel from recycled steel scrap.

Therefore, steel in New Zealand may be higher carbon than steel made elsewhere. However, carbon associated with shipping needs to also be considered.

HERA's Zero Carbon Steel program considers both carbon in manufacturing and shipping, as well as fabrication/rollforming.

What are the impediments to structural steel reuse?

Structural Steel is ideal for re-use and there are many examples of re-use. For example, the Six Star Greenstar Mason Bros building in 139 Pakenham Street, Wynyard Quarter, which included the adaptive re-use of an old warehouse into a 3-storey office building. In 2019, this building was New Zealand's first to achieve the highest possible rating for environmental impact from the New Zealand Green Building Council.

SCNZ has also prepared some case studies, such as the profiling of 90 year old repurposed structural steel used in Red Steel's head office in Hawke's Bay, and the restoration and refurbishment of CAB – one of the first structural steel-framed buildings in New Zealand. Both demonstrate that steel can be recycled and reused endlessly without compromising its physical properties, and offer significant opportunity to vastly reduce carbon footprint in a project.

HERA is currently scoping a research project, in collaboration with WSP, to determine the key barriers to greater re-use of structural steel and to develop a material passport for structural steel.

How do I get Green Star credits for structural steel?

The Sustainable Steel Council has prepared a roadmap for attaining Greenstar points. It is available free to Sustainable Steel Council members. Staff on HERA's Structural Systems team are certified Green Star Practitioners and can give high level guidance if required.

How can I go zero carbon?

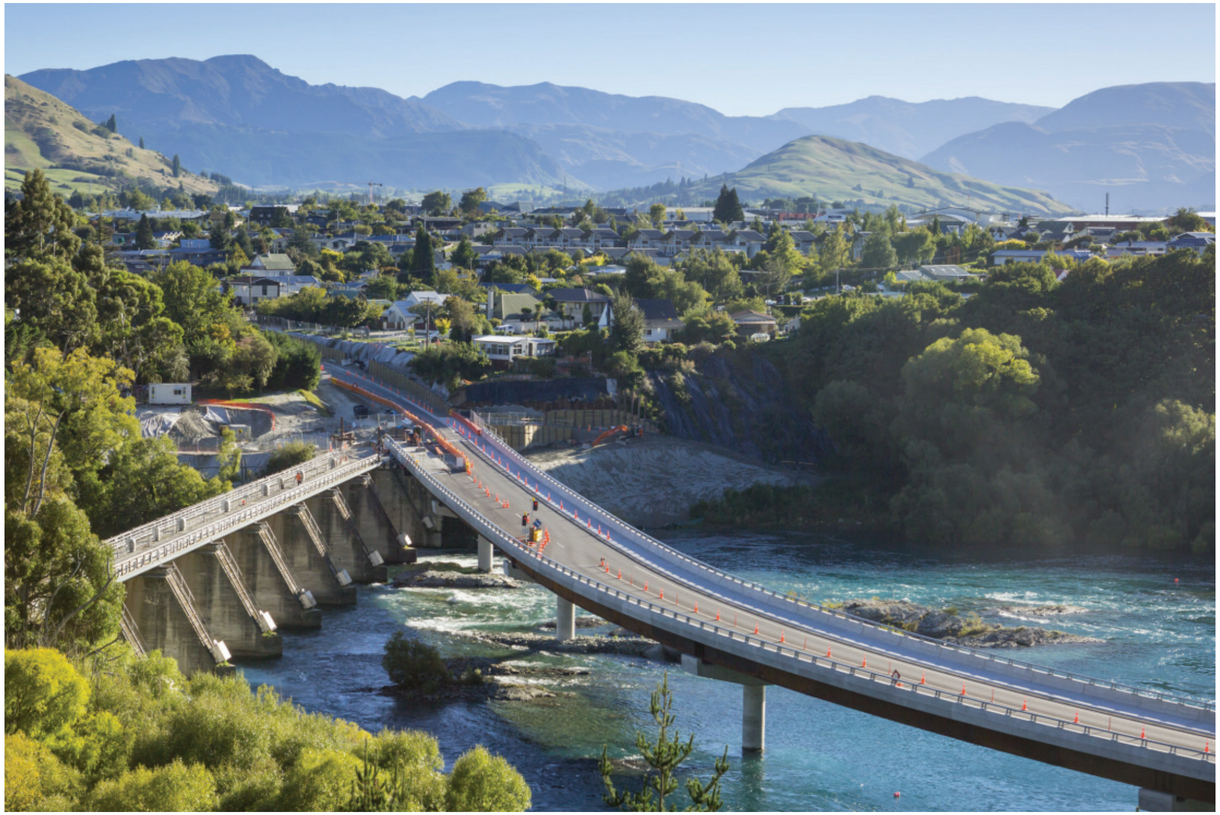
HERA has developed the zero carbon steel program to offset carbon in steel. However, we also encourage our members to offset their operational carbon emissions to go completely carbon zero.

To assist the steel industry to do this, we have created a case study of HERA's own carbon footprint calculations and offsetting. This includes the spreadsheets we used to determine our carbon emissions and provides a comprehensive starting point for anyone in the channel wishing to go carbon neutral.

What is the sustainability roadmap for the steel industry?

It is based on the Living Standards Framework so covers the natural, human, social and physical capital categories.

HERA has also released a webinar on the decarbonisation journey for steel.



How do I choose a supplier who is on the sustainability journey?

The Sustainable Steel Council has been created to assist the industry to improve its sustainability performance. It runs a certification program against its Charter, which is based on the Living Standards Framework.

Certified members are listed and there are tiered categories:

- gold;
- silver; and
- bronze.

These tiers help identify what stage of the sustainability journey organisations are on.

What is Module D and why is it important in assessing construction carbon?

When undertaking lifecycle carbon assessments for buildings, these are best calculated in a standardised way, e.g. via Environmental Product Declarations (EPDs), or by modules to make the calculations transparent. The modules used in European Standards are:

Module A – from production of the construction products and their assembly into buildings;
Module B – the use of the building over its design life;
Module C – the end-of-life of the building including demolition and disposal of the demolition waste; and
Module D – considers building lifetime, including the reuse and recycling potential of materials and products recovered from the end-of-life of the building.

Module D, takes the assessment from cradle to grave and makes it cradle to cradle, i.e. makes it a circular assessment versus a linear one. It identifies the benefits of materials, such as steel, that are highly recyclable and reusable. If you rely upon a Module A assessment only, for example, you could have the perverse outcome of comparing a product that will be recycled at end of life (e.g. steel) to one that will typically go to landfill (e.g. treated timber). Therefore, BS EN 15804:2019 (the European standard for developing construction EPDs) now mandates the reporting of Modules A1-A3, C1-C4 and D for almost all construction products.

Module D is calculated based on the avoided impacts of primary production, so if a product is recycled, the Module D benefit is the avoided impact. This is the impact avoided by not producing the product via the primary production route. Where there is a loss of quality, then a value-correction factor is applied to reflect the lower value of this type of recycling.

If someone is making comparative claims of carbon performance across materials, e.g. comparing timber to steel, you should check if a Module D assessment has been included (it should be) and if biogenic carbon has been included (it should not be). It should be noted that the deviation between the results obtained from different methods for calculating biogenic carbon in timber was 16% at the building scale and between 35% and 200% at the component scale (Hoxha et al., 2020). This demonstrates the concerns around consistency of calculating a reliable estimate for biogenic carbon. The same study identified "that land-use and land-use-change (LULUC) impacts and carbon-storage credits are not included in most existing methods. In addition, when limiting the system boundary to certain life-cycle stages, methods using the −1/+1 criterion can lead to net negative results for the global warming (GW) score, failing to provide accurate data to inform decision-making" (Hoxha et al., 2020).

Hoxha, E., Passer, A., Saade, M.R.M., Trigaux, D., Shuttleworth, A., Pittau, F., Allacker, K. and Habert, G., (2020). Biogenic carbon in buildings: a critical overview of LCA methods. Buildings and Cities, 1(1), pp.504–524. DOI: http://doi.org/10.5334/bc.46

What is an Environmental Product Declaration (EPD)?

An Environmental Product Declaration (EPD) is a third-party independently verified and registered document whereby manufacturers report third-party verified data about the environmental performance of their products and services.

HERA is in the process of developing an EPD library for all steel product EPDs that are commonly used in Aotearoa New Zealand. There are many limitations when using EPD's to compare inter-material performance (e.g. timber vs steel). However, they can be useful for intra-material comparisons (e.g. steel of one specific type from one mill vs steel of the same specific type from another mill).

As EPDs are independently verified and registered, they are currently the most robust source of data for input into carbon calculation.

What is the difference between LCA and EPDs?

EPD data is based on life cycle assessment (LCA).

LCA is an analytical method to systematically and quantitatively assess the environmental impacts of a product or service.

LCA studies underpin the data used in developing EPDs. Many LCA studies produce data that does not go through the EPD verification process. Such data may be reliable (particularly for comparing one design to another) but is not independently verified and registered using the standard process.

HERA is a member of LCA New Zealand.

Got more questions?

Contact us: info@hera.org.nz