REDUCING REINFORCEMENT CARBON EMISSIONS

REINFORCED INSIGHT

BAR
BRITISH ASSOCIATION OF REINFORCEMENT
www.uk-bar.org

First published 2024

www.UK-BAR.org

The British Association of Reinforcement (BAR) is the trade association of UK manufacturers and fabricators of steel reinforcement products including cut and bent bar and mesh as well as suppliers of associated reinforcement products. BAR aims to add value to the UK reinforcement sector through promotion of good industry and health and safety practices, market and product development, and forwarding the UK reinforced concrete industry as a whole.

BAR
BRITISH ASSOCIATION OF REINFORCEMENT
www.**uk-bar**.org

INTRODUCTION

Both the manufacturer and fabricator members of the British Association of Reinforcement (BAR) are fully committed to 'raising the bar' when it comes to implementing and achieving the sustainability objectives and programmes that will see their CO_2 emissions be significantly reduced as they aim to achieve net zero.

The sustainability objectives are fully embedded within the BAR members' business approach. Whilst their carbon emission initiatives demonstrate what can be achieved when the commitment is there.

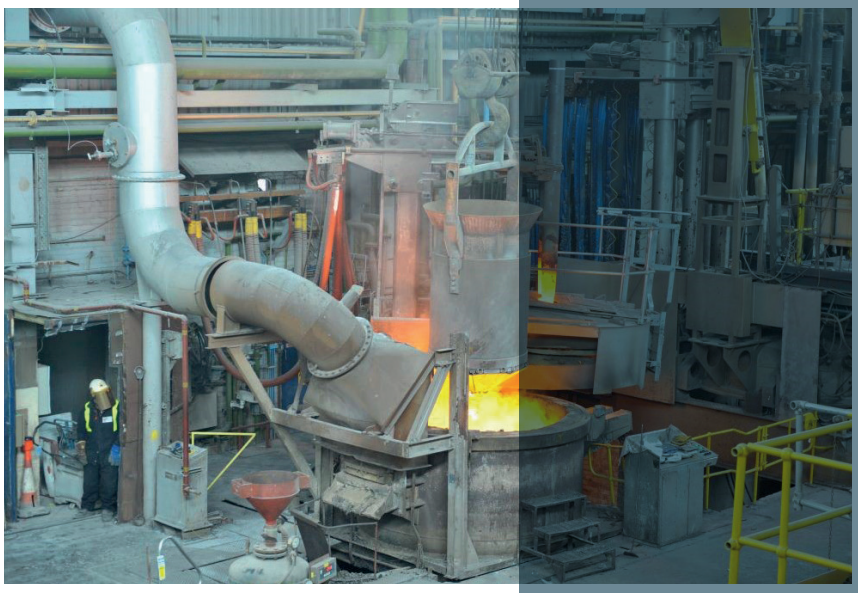
This report highlights those objectives and initiatives in order to underline how BAR members can assist government and industry clients including tier one and tier two contractors achieve their own objectives and net zero commitments.

REINFORCED COMMITMENT

There are two common steelmaking processes used for manufacturing steel: Basic Oxygen Steelmaking (BOS) and Electric Arc Furnace (EAF) steelmaking. The BOS route is the most widely used steelmaking process worldwide and involves the smelting of iron ore, coal and other raw materials in a two-stage process. The EAF production process involves passing an electric charge through scrap metal, melting it and recycling it into new steel products.

Steel production using the EAF method consumes only a third of the embodied energy, emits one sixth of the CO2 and produces approximately half the amount of co-products (waste) compared with BOS. BAR members are fully committed to only manufacturing and fabricating EAF produced steel reinforcement.

The steel reinforcement produced by BAR reinforcement manufacturing members is made from 98% recycled scrap metal and can itself be recovered, recycled and re-used. The final 2% consists of ferro-alloys and minerals added to the production process in order to remove impurities from the steel and to ensure the finished product has the correct properties. The impurities are removed through the blast furnace slag. This acts as a steel by-product that is recycled as an aggregate for the construction industry and as clinker for the concrete industry thereby reducing mineral and aggregate extraction. All other by-products of production are recycled, ranging from mill-scale – used as an iron-bearing source in the cement industry – to flue dust, from which zinc and other metals are recovered.



GREEN HOUSE GAS EMISSIONS REDUCTION

BAR members are committed to reducing the greenhouse gas emissions associated with their operations and processes to a level that is as low as is practically possible through the use of a greener national grid electricity supply, local supply chains, improved transport efficiencies, staff education and ongoing process improvement strategies.

WASTE AND RECYCLING

BAR members have implemented significant management strategies to ensure that all waste is dealt with according the principles of waste hierarchy including initiatives aimed at reducing waste creation and ensuring that waste is segregated appropriately.

In terms of reinforcement manufacturing, during the production process impurities are removed through the furnace slag, a steel by-product that is recycled as an aggregate for the construction industry. All other by-products of production are recycled, ranging from mill-scale – used as an iron-bearing source in the cement industry – to flue dust, from which zinc and other metals are recovered.

All scrap metal is recycled. All BAR reinforcement products are 100% recyclable at end of life. Recycling using EAF produces up to 86 per cent less carbon than manufacturing new steel.

TRANSPORTATION

BAR members are committed to transportation logistics that minimise their environmental impacts. Deliveries are tracked in order to analyse performance and make further improvements. Each delivery is planned to carry the maximum amount of steel as is practicable and safe in order to reduce the number of trips and so reduce environmental impacts. Where possible rail and waterborne alternatives to road transportation are actively examined and, if practical, used.

ACCREDITATION AND COMPLIANCE COMMITMENT

BAR members are fully accredited and compliant with the relevant responsible sourcing and environmental certification schemes. Environmental performance and data are monitored and reported.

Recognised accreditations include:

- ISO 14001 – an international standard aimed at minimising the environmental impact of operations
- Carbon Reduction Commitment Energy Efficiency Scheme – A UK Government-led scheme to encourage energy efficiency and reduce carbon emissions
- BES 6001 – the Building Research Establishment standard for ensuring that construction product materials are responsibly sourced
- Eco Reinforcement – assesses responsible sourcing using the BES 6001 framework
- BBA Reinforcing Steel scheme - assesses manufacturing, process control and management systems to industry defined standards
- CARES Sustainable Constructional Steels scheme – assesses and accredits the environmental, social and economic management of manufacturers and fabricators.
- SustSteel mark - the mark covers production of steel products for the construction sector, complying with the defined requirements for the economic, environmental and social aspects of sustainability.

Customers of BAR members can be assured of a quality product backed by a commitment to reduce environment impact and carbon emissions.

CARBON REDUCTION INITIATIVES CASE STUDIES

The following case studies underline the investment that BAR members are making in order to reduce their carbon emissions as they work towards net zero.

CASE STUDY: ARCELORMITTAL XCARB INITIATIVE

To forward the reduction in carbon emissions, BAR member ArcelorMittal Europe has created the XCarb® initiative which consists of 3 principles focused on reducing the emissions to net zero in all of their works by 2050.

The three-core principle consist of:

- XCarb® Innovation funds

  ArcelorMittal has launched an innovation fund which will invest up to $100 million annually in groundbreaking companies developing pioneering or breakthrough technologies that will accelerate the steel industry's transition to carbon neutral steelmaking.

- XCarb® Green Steel certificates

  The certificates use a conversion factor that represents the average CO_2 intensity of integrated steelmaking in Europe. They offer customers the opportunity to buy certificates attached to their physical orders of steel, enabling them to report a reduction in their Scope 3 carbon emissions in accordance with the GHG Protocol Corporate Accounting and Reporting Standard.

- XCarb® recycled and renewable products

  XCarb® recycled and renewably produced steel uses up to 100% scrap. All the electricity needed comes from certified renewable sources such as solar and wind power. The energy is provided by suppliers who are connected to the same grid as the ArcelorMittal production sites.

Being part of ArcelorMittal, AMCS and Kent Wire have direct access to XCarb® rebar products when their customer's specification requires a low carbon alternative to traditionally produced rebar. Producing fabric reinforcement and prefabricated rebar cages using steel with a dramatically reduced volume of embedded carbon is easily achievable for both businesses. Manufacturing rebar using XCarb® steel will contribute only 300 kg CO_2/tonne of steel thanks to the XCarb initiative.

XCarb® steel is independently verified and certified with an XCarb® Green Steel certificate issued by ArcelorMittal Europe. These certificates will pass the CO_2 savings achieved by ArcelorMittal Europe Long Products to AMCS' and Kent Wire's customers.

XCarb® steel reinforcement also holds an Environmental Production Declaration (EPD). The EPD provides a life-cycle assessment detailing the complete environmental footprint of reinforcing steel in bars sold under ArcelorMittal's XCarb® recycled and renewable products produced using a certified supply of renewable electricity. It certifies a global warming potential of only 300 kg CO_2 per tonne of finished steel, which is far below the average carbon footprint of other rebars available on the market. The EPD has been issued by Germany's Institut Bauen und Umwelt (IBU), according to international standards.

To further enhance the CO_2 reduction, XCarb® rebar produced at ArcelorMittal's Warsaw mill will be transported by train to the port at Gdansk, transhipped and sailed directly to Chatham Docks for use in the facility on the quayside. This journey will only generate 30kg CO_2/tonne, significantly less than being transported by road.

Kent Wire and AMCS are also using additional solutions to further drive the emissions to zero in transportation by optimising onward journeys of finished product and working with hauliers best suited to making deliveries using the shortest overall journeys possible.

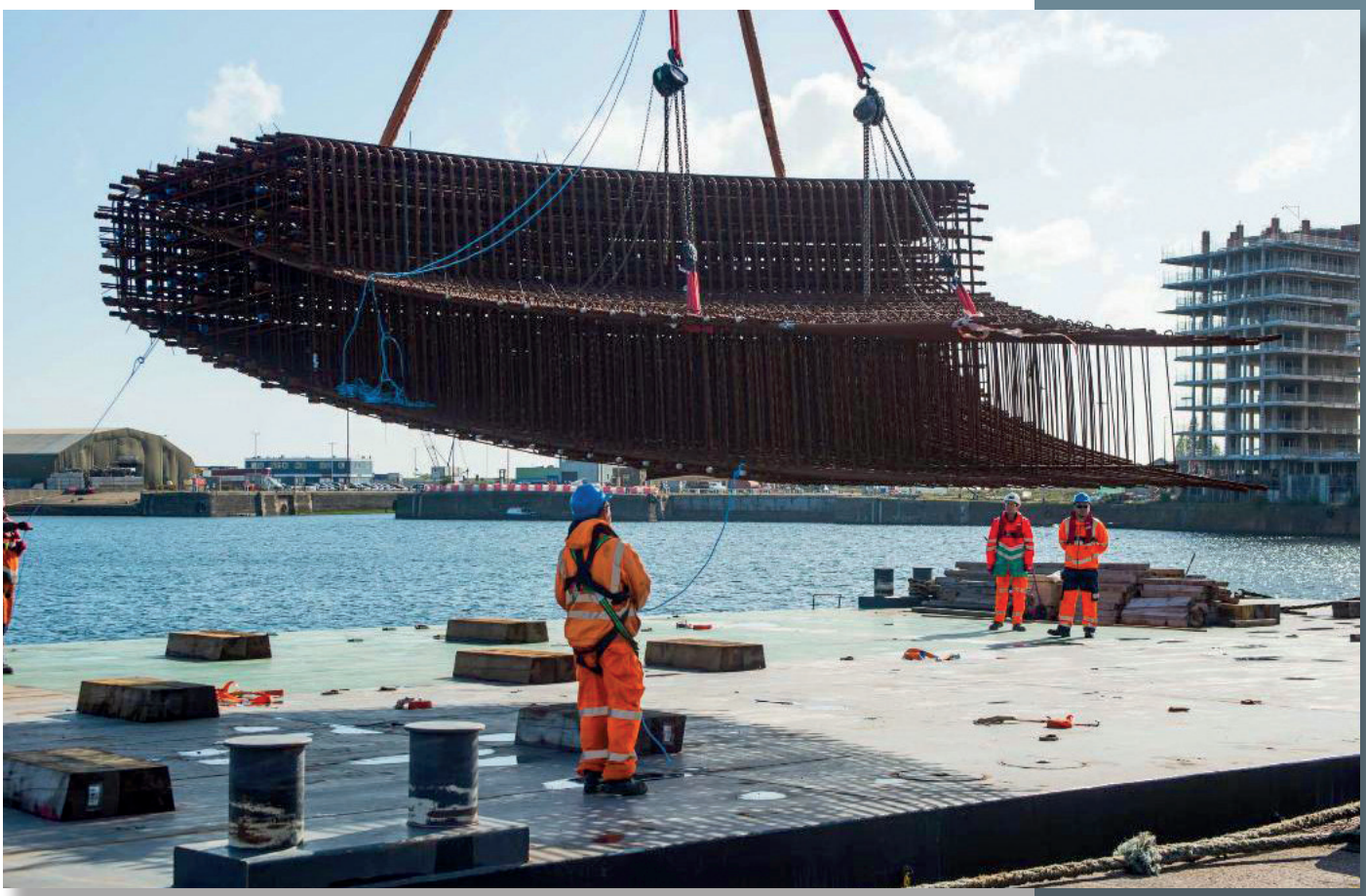
ArcelorMittal Construction Solutions and ArcelorMittal Kent Wire Ltd are continually aiming to reduce their carbon emissions to meet the not only the UK Government requirements but also to achieve their own goal to minimize their environmental impact. For this, the companies are using 100% renewable electricity sources, which result in zero carbon emissions in the energy used at their works in Chatham, Kent.

CASE STUDY: THAMES TIDEWAY REINFORCEMENT DELIVERY

ArcelorMittal Kent Wire and ArcelorMittal Construction Solutions offer prime examples of how alternative transportation solutions and significantly reduce environmental impacts. Fortunate to have a Chatham dockside location, ArcelorMittal Kent Wire bring in over 80% of its raw materials in by vessel, therefore significantly reducing the number of road traffic movements. Similarly, ArcelorMittal Construction Services (AMCS) makes full use of barge transportation for site deliveries as demonstrated by its supply of prefabricated reinforcement for the Thames Tideway project.

The Thames Water Tideway project is a 25km long and 7.2m wide tunnel bored under the River Thames that will provide extra sewage capacity The Tunnel will collect sewage so it can be treated before entering the river. The tunnel will capture all the 'first flush' from the sewers after heavy rain. This contains sediment built-up during periods of dry weather and causes the most damage. Instead of over 50 sewage spills a year, there will only be around four. These will mostly contain surface water runoff after heavy storms.

AMCS prefabricated a number of key units for the project for the Tideway Chamber Wharf Shaft including the 300 tonne inverted reinforcement dome for the shaft base slab. The dome consists of eight "pie-slice" segments, each weighing around 28 tonnes and measuring over 9m long and wide, over 3m high. They were constructed using custom made jigs to ensure precise connection between the elements in the bottom of the shaft on site. Central dished mats were then added to complete the construction. The entire base comprised of these prefabricated elements was delivered by barge from AMCS' Chatham dock base directly to the construction site. AMCS also



provided the prefabricated reinforcement for the elements for tunnel portals and the lining walls for inside the shaft. These three portals, each containing in excess of 120 tonnes of reinforcement, are being pre-fabricated in five or six sub elements, each with multiple layers of 32mm and 40mm bars precisely located and fixed to ensure seamless fit when positioning on site.

The base units, which are the largest sections, are over 5m tall, 3m deep at the widest point and over 17m long. They are fabricated from mainly 32mm and 40mm bars and all weigh in excess of 30 tonnes. Similar to the base slab reinforcement, the portal reinforcement segments were delivered by barge to site.

AMCS water logistics partner, GPS Marine, undertook deliveries from the ArcelorMittal manufacturing facility in Chatham Docks directly the Essex side of the construction site. The barge vessels used 100% renewable fuel reducing emissions by 90%. GPS Marine has won two Green Apple Transport Sector Gold awards for its work in eliminating CO_2 from its fleet of tugs and vessels.

In total, for the Thames Tideway project, GPS Marine delivered 530 reinforcement elements via 67 barge trips. To deliver the same amount by road would have required 530 truck deliveries. Using the Datascope system to calculate CO_2, this would have resulted in a carbon emission footprint of 33,307 Kg CO_2. This compares with a total of 6,680.4 Kg CO_2 for transportation of the elements by barge. A CO_2 reduction of 80%.

CASE STUDY: CEMENT 2 ZERO

The Materials Processing Institute has successfully completed the pilot Electric Arc Furnace (EAF) trials, a major project milestone for the UKRI Cement 2 Zero project. These trials started in September 2022 and involved 12 induction furnace trials and 8 eight trials in the Institute's 7 tonne EAF.

These trials have been developing and testing the use of end-of-life cement as an electric arc furnace flux to produce steel, whilst also capturing the slag to produce clinker for use in the cement industry.

The trials have enabled finalisation of the process for making electric cement and to also successfully de-risk the process for the next stage of the project, which will be the full-scale trials at Celsa UK using their industrial EAF.

BAR member Celsa is a partner in Cement 2 Zero. The industrial trials at Celsa UK are due to be completed in February 2025.

Cement 2 Zero, which has secured £6.5 million of Government funding from UKRI as part of the Transforming Foundation Industries Challenge, aims to further advance the construction, cement and steel sectors' decarbonisation journey to net zero industries of the future, to help meet the UK Government's commitment of achieving Net Zero by 2050.

Led by the Materials Processing Institute, supported by the University of Cambridge (UoC), and in collaboration with key players in the supply chain, Cement 2 Zero is the first collaborative trial of its kind, to address the global construction industry's biggest challenge of decarbonisation, in response to the climate emergency.

Concrete is the most widely used material on earth, after water, and it is fundamental to our way of life, our economy and shaping our world. However, the chemical and thermal combustion processes involved in the production of cement are a significant source of carbon dioxide (CO_2) emissions – with more than 4 billion t of cement produced each year, accounting for around seven per cent of global CO2 emissions, according to the Global Cement and Concrete Association (GCCA). In the UK, concrete and cement account for 1.5 per cent of UK carbon dioxide emissions.

The Cement 2 Zero project will demonstrate an economically viable route to advancing the decarbonisation journey of the cement industry by eliminating emissions derived from cement production. This will have a positive impact on world net-zero targets.

The two-year industrial trial will test each stage of the production process and brings together the expertise of the Materials Processing Institute, the University of Cambridge and key supply chain partners – Atkins, Balfour Beatty, CELSA, Day Aggregates and Tarmac – before using the innovative product in a live UK construction project.

The project is based on the Cambridge Electric Cement research project at the University of Cambridge. There, Dr Cyrille Dunant, Professor Julian Allwood and Dr Philippa Horton, invented a process that converts construction and demolition waste to cement over molten steel, using an Electric Arc Furnace (EAF), which is used to recycle scrap steel. The Cement 2 Zero project aims to demonstrate that concrete can be recycled to create a Slag Forming addition which could, when cooled rapidly, replace Portland cement.

Traditional Portland clinker, one of the main ingredients in cement, is produced by firing limestone and other minerals in a kiln at extremely high temperatures (1,450 degrees Celsius), a process which accounts for more than 50 per cent of the cement sectors' emissions.

By contrast, Cement 2 Zero will use recycled cement as the flux in the electric steel recycling process (EAF powered by renewables), the by-product of which, when cooled and ground, produces Portland cement clinker, which is then blended to make 'zero-emissions' cement.

Therefore, this innovative cement product (CEC) could be made in a virtuous recycling loop, that not only eliminates the significant emissions of cement and steel production, but also saves raw materials.

The Cement 2 Zero project will investigate both the technical and commercial aspects of upscaling Cambridge Electric Cement (CEC) production to produce 20 t of the world's first zero emissions cement. Alongside other industry developments, the project will contribute to change cement production CO_2 emissions. Cement 2 Zero aims to transform the cement and steel industries, creating a zero-emission supply chain from demolition to construction.

CASE STUDY: THE 100 CLUB

Express Reinforcements Ltd has launched a new sustainability campaign: 'The 100 Club'. The Club is open to all clients and contractors who want reinforcement that is 100% UK supply chain supporting UK manufacturing jobs with 100% full UK traceability. In addition, it is open to those who seek to reduce the CO_2 impact of their construction projects.

100% of the reinforcement bar and coil used by Express Reinforcements for cut and bent rebar and mesh is produced via the Electric Arc Furnace (EAF) recycled scrap route. Compared to the Basic Oxygen Steelmaking (BOS) process, EAF steel consumes only a third of the embodied energy, emits one sixth of the CO_2 and produces approximately half the amount of co-products (waste).

In addition, the steel reinforcement used is made from 98% recycled scrap metal and can itself be recovered, recycled and re-used. The final 2% consists of ferro-alloys and minerals added to the production process in order to remove impurities from the steel and to ensure the finished product has the correct properties. The impurities are removed through the blast furnace slag. This acts as a steel by-product that is recycled as an aggregate for the construction industry and as clinker for the concrete industry thereby reducing mineral and aggregate extraction. All other by-products of production are recycled, ranging from mill-scale – used as an iron-bearing source in the cement industry – to flue dust, from which zinc and other metals are recovered

Express Reinforcements believe that its ongoing investment into reducing its CO_2 emissions means that it is 100% one of the lowest carbon UK suppliers for cut and bent rebar based on its independently verified Environmental Product Declaration (EPD). The EPD assists customers by providing exact reinforcement carbon figures rather than unverified industry averages. The EPD provides 100% assurance of accurate CO_2 data for fabricated reinforcement. Importantly, the data includes CO_2 values for transportation from the steel mill to the Express factory and also the reinforcement cut and bent production process itself. For even more in depth reporting on larger projects, further CO_2 data can be included which calculates and includes the associated CO_2 value for transportation from the Express factory to a construction site. This data can be corroborated through Express' Environmental Product Declaration (EPD) which has recently been updated and re-issued by a 100% fully independent certifying body.

The Express Reinforcements 100 Club aims to provide its customers with 100 percent assurance of reinforcement with the lowest possible CO_2 impact.

CASE STUDY: ABERDEEN WESTERN PERIPHERAL ROUTE

Sustainability was a key criteria for the supply of reinforcement by BAR fabricator member BRC Ltd. The company competed successfully for contractor AWPR Construction Joint Venture for the supply of 33,000 tonners of rebar for the Aberdeen Western Peripheral Route, Balmedie to Tipperty section. The 58km Route is one the largest infrastructure projects to have been built in Scotland.

The project was delivered by Transport Scotland on behalf of the Scottish Government and in partnership with Aberdeen City Council and Aberdeenshire Council. Aberdeen Roads Limited (Balfour Beatty Investments Limited, Carillion Private Finance (Transport) Limited and Galliford Try Investments Limited) was awarded the contract to build the AWPR/B-T in December 2014. Subsequently AWPR Construction Joint Venture, comprising of Balfour Beatty, Morrison Construction (Galliford Try) and Carillion, were appointed to construct the road.

Aberdeen is sandwiched between the River Dee and River Don and lies at the intersection of several major roads, including the A90 and A96 trunk roads which historically channel much of the heavy traffic into the city centre. At peak times of the day, up to 22,000 vehicles can travel along some sections. The need for an upgraded road had been mooted as far back as 1952.

Most of the new road is two-lane dual carriageway, with three-lane dual carriageway operating over some shorter sections helping the flow of both long-distance traffic as well as facilitating peripheral, shorter journeys. In addition to the 58km new road there is 40km of new side roads, 75 bridges including 2 major crossings over the River Dee and the River Don, a bridge over the Aberdeen-Inverness rail line and 80 culverts.

BRC guaranteed the highest sustainability credentials of rebar steel used, specifically 100% of the steel made in the UK with 98% recycled content and produced 100% in an Electrical Arc Furnace (EAF), the most sustainable steel making process.

Additionally, and from the logistics point of view, further reduction in carbon footprint was achieved by delivering into Scotland, mainly by rail from the Celsa mill in Cardiff. Moreover, and throughout the whole project, special attention was made to engage collaboratively with the client, for example specific rebar bar lengths were determined and delivered, hence achieving a more efficient design and reduction of waste. Sensitivity to the environmental considerations was also recognised as a key to the success of the project delivery and BRC worked closely with AWPR Construction Joint Venture on programmed deliveries to ensure every effort was made to mitigate any impact and disturbance on the area and communities whilst the project was under construction.

RAISE THE BAR

FOR REINFORCED SUCCESS CHOOSE A MEMBER OF THE BRITISH ASSOCIATION OF REINFORCEMENT

- CARES APPROVED
- COMMITTED TO HEALTH AND SAFETY
- RAISING STANDARDS
- COMMITTED TO SUSTAINABILITY
- RESPONSIBLY SOURCED
- DELIVERING QUALITY AND ADDED VALUE
- PRODUCT INNOVATION AND PROCESS DEVELOPMENT

BAR
BRITISH ASSOCIATION OF REINFORCEMENT

BAR MEMBERS: GIVING YOUR PROJECT A REINFORCED ADVANTAGE

www.**uk-bar**.org