

# Pre-qualification Document

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**Macalloy**  
Threaded Bar Systems Trusted Worldwide

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# About Us

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## Macalloy are global leaders in the manufacture of threaded tension steel bars and cable systems.

Based in the heart of the UK's steelmaking industry, we have a history that can be traced back 100 years. However, we are always looking forward, and we constantly strive to innovate and improve quality to meet the needs of the modern construction industry. Our products have been central to the construction of many prestigious global landmarks including four of the Russian World Cup Stadiums, the 7-star Burj Al-Arab Hotel in Dubai, Marina Bay Sands in Singapore and Jubilee Bridge in London.

### **Custom solutions to suit static and loaded applications.**

We pride ourselves on our strong, customer-focused ethos, and have developed a number of specialised products and services specifically for our customer base of consulting engineers and architects.

Our commitment to innovation and willingness to work alongside our customers to develop solutions to industry problem, are the qualities that have enabled us to maintain our position as market leaders for 100 years.

### **Why work with us?**

- Leading suppliers to the construction industry for over 100 years
- Exporting worldwide since the 1960s
- Industry experts in steel threaded bar and cable systems
- Innovative solutions to challenges in the construction industry
- Home of the PT Bar
- Originators of the Tension Structure System
- Technical support from our experienced design and engineering team
- Internally and externally audited for quality
- Internationally-recognised award winners
- Holders of European and worldwide technical product approvals
- Often imitated but never equalled

# History

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## **Based in Sheffield, at the heart of the UK’s steel industry, Macalloy’s roots can be traced back 100 years.**

In 1921, McCalls and Company Limited was founded by TH McCall, Edwin Llweylllyn Raworth and CW Hamilton in a stock yard on Queens Street, Sheffield. They supplied steel rods and bars which were in high demand for the expanding concrete trade. The company grew very quickly and expanded into supplying straight or bent rods and bars in cut lengths.

In 1927, as demand grew, the company moved to the Railway Engineering Sheds at Nunnery Lane, Sheffield.

The company connected with United Strip Bar Mills and Templeborough Rolling Mills, sourcing rods in coil. The Templeborough Mills helped finance McCalls to relocate to a new plant at their site on Trafalgar Day – 21st October 1929. This move enabled the company to manufacture more diameters of bars, which were required for the dynamic construction industry.

Over the next two decades, McCalls and Company Ltd expanded as demand for their products increased, and in 1948 the company introduced a ‘post tension’ bar into the new ‘post tensioned’ concrete market.

This was a developing trend in concrete construction and the Macalloy post tension bar proved an instant success. Sales of the post tensioning bar grew and in 1960, Macalloy's prestressing bars were used exclusively in the 500ft central section of the Medway Bridge on the M2 motorway, which was at the time the world's largest pre-stressed concrete span.

Later in 1962, the company became a totally-owned subsidiary of The United Steel Companies Ltd (which in 1968 was nationalised to become British Steel). In 1965, they expanded into larger premises at the former Yorkshire Engineering Company Ltd factory at Meadowhall Road, Sheffield. In 1966, the Meadowhall site underwent a major refurbishment, increasing production to 2,500 tonnes per week and installing two new continuous tracks to support new electric cranes, giving complete handling coverage over the whole area.

In 1975, the company was purchased by ASW Allied Steel and Wire Ltd, itself a buy out from the Tremorfa Steel works in Cardiff. The company then moved again to larger facilities in Hawke Street in Sheffield, enabling McCalls to advance and create new products including a new architectural Tension Structures range.

Growth into worldwide markets developed in the 1990s under ASW and trading as McCalls Special Products Ltd. A few years later ASW acquired a French company, Arteon SA, which extended distribution through Europe and expansion into Germany, Switzerland and Austria.

Construction in the Asian markets began to boom at this time and Macalloy's post tension systems, tie bars and architectural ties were used extensively in major large-scale projects in Hong Kong, Malaysia, Singapore, Japan and the Philippines.

In recognition of the company's achievements, Macalloy were awarded the Queens Award for Export in 1996. At the time, exports accounted for 65% of the company's productivity.

In 2003, the company moved back into private ownership following a MBO headed by the current Managing Director Peter Hoy, and in 2006 the company commissioned a purpose-built factory on the Old Dinnington Colliery site where it remains today.

## **Macalloy today**

Macalloy now trades from purpose-built facilities in Dinnington, Sheffield. This move enabled the company to increase capacity and continue to supply the highest quality products, including:

- Tension structures
- Facade engineering
- Post-tensioning
- Ground engineering
- Site services – equipment, training and hire

Over the years, Macalloy has developed strong business partnerships, providing consulting engineers and architects with a comprehensive choice of products and services.

Our supply chain continues to expand via an international network of Macalloy agents and distributors, ensuring continued growth in the global market.

Macalloy products are used throughout the construction industry and have been featured in many prestigious global products including four of the Russian World Cup Stadiums, the 7-star Burj Al-Arab Hotel, Dubai, Marina Bay Sands, Singapore and Jubilee Bridge, London.



# Quality

The Macalloy brand is synonymous with quality, and we have comprehensive quality management systems and processes in place to ensure every product is manufactured to the same high standard our customers expect.

Our quality standards mean that we are approved to supply products for:

- Residential and office buildings
- Large-area roof structures overhanging places of public assembly/stadiums
- Buildings with more than 15 floors
- Pedestrian and bicycle bridges
- Roadway / Railway bridges
- Fairground rides
- Towers and masts including antenna support structures
- Crane tracks
- Cylindrical towers such as steel smoke stacks
- Canopies / Facades / Crane Bases / Mining Conveyors and Stackers / Wharfs / Tunnel Walls / Floating or Hanging Staircases

## Approvals and certifications

Our quality assurance system complies with the requirements of BS EN ISO 9001:2015 as well as the FPC requirements of BS EN 1090 to a level 3 execution class.

For our Macalloy 1030 systems, we hold a European Technical Approval ETA 21/0054 which has been created against the EOTA European Assessment Document EAD 160004-00-0301. To meet the requirements of EAD 160004-00-0301, a factory production control plan is in place. It is a prerequisite of EAD 160004-00-0301 that bars comply with the preliminary European standard prEN 10138.

Macalloy Tension Rod systems also have their own European Technical Approval ETA 21/0053, which has been mapped against the requirements of the EOTA European Assessment Document EAD 200032-00-0602. We also have factory production control (FPC) plans in place for these systems.

Both ETA21/0053, ETA21/0054 and BS EN ISO 9001 : 2015 accreditations are audited bi-annually by our notified approval body, British Board of Agrément (BBA).

Bars and fittings are routinely tested in accordance with the factory production controls which have been put in place to meet ETA requirements (we also have on-site facilities to load test tendon assemblies up to 2500kN).

- Tensile / Anchorage tests up to 2500kN loads
- Brinell / Rockwell Hardness testing
- Stress Relaxation Rig - 1000kN

# Our Carbon Footprint

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Macalloy is committed to buying 'green steel' to help protect our environment and reduce carbon emissions. Our manufacturing process is based on recycled steel scrap and a Nordic fossil-free electricity mix. As a result, the carbon footprint of our steel bar is a full 80 percent lower than the global average.

## Sustainability

Macalloy takes responsibility for conducting its business in a sustainable manner, encompassing everything from quality and customer relations to employees, safety and the environment.

Environmental aspects have always been a fundamental part of Macalloy's business. Macalloy has reduced carbon emissions through efficient processes, the use of steel using fossil-free electricity and dedicated investments such as conversions to fossil-free fuels for heat treatment resulting in a carbon footprint 80 % lower than the global average. Macalloy's goal is to achieve zero-carbon emission steel. Already as of January 2022, Macalloy provides products based solely on carbon-neutral steel production by counterbalance the remaining carbon emissions through carbon offsets.

Macalloy differentiates itself in the market by using only steel scrap as input material instead of iron ore. Since steel can be recycled an infinite number of times without its properties deteriorating, Macalloy uses manufactured steel with a lower climate impact without compromising the quality of the steel.

## Recyclability

Steel is 100 % recyclable, which means it can be re-melted to produce new steel of the same quality an infinite amount of times. The iron atoms are indestructible, and therefore steel can be produced from recycled steel scrap without compromising the quality. For every newly produced ton of steel using recycled material 1100 kg of iron ore and 600 kg of coal can be conserved as well as energy savings of 74 %, compared with the same process using raw materials. Macalloy steel consists of 97,2 % recycled steel

## Recycled Content

Macalloy products consist of an average of 97.2 % recycled steel scrap, which is a very high content. If just considering the source for iron, it is from over 99% recycled steel scrap. Macalloy's suppliers recycle their own steel scrap, as well as scrap from downstream manufacturing industries and end-of-life products, to conserve energy, emissions and natural resources. By using recycled steel, the Earth's valuable resources are conserved, no virgin material has to be used and it diverts useful materials from going to landfills. This makes us an important part of the circular economy.

## Environmental Product Declaration

(See appendix re certification)



# Products



# Tension Bars

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Since the early 1990's the architectural range of tension bars have grown in popularity providing designers an opportunity to offer contemporary designs and solutions.

The lighter carbon and stainless bars are used in lightweight canopies, facades and suspended structures. The high strength bars provide support for bridge decks, in bolstering bridges the good fatigue properties of the bar are an important design feature in road, tram and pedestrian bridges alike.

## **Benefits of Macalloy Tension Bars**

- Fatigue resistant rolled thread
- Available in 460N/mm<sup>2</sup>, 520N/mm<sup>2</sup> and now a 550N/mm<sup>2</sup> strength for both carbon and stainless
- All products compliant with ETA21/0053 and CE compliant
- Bars and fittings can be supplied primed or painted and/or hot dipped galvanised to BS1461:2009
- Bespoke fittings can be designed to suit customer applications
- Technical literature is available with design calculations and loadings to EC3
- Macalloy engineers are always available to help

In the 1980s Sir Norman Forster was commissioned by the French car company Renault to design a building for their UK operations the brief was to maximise the internal space by hanging the roof using external bracing the building went on to win numerous design awards and began a trend in wide span structural design using Macalloy Tension Structure products.



Macalloy tension bar range includes a 460N/mm<sup>2</sup>, 520N/mm<sup>2</sup> and the new 550N/mm<sup>2</sup> [ETA pending] available in carbon and stainless steel.

All systems are 9001 accredited and approved to European technical approval ETA21/0053, providing the CE certification. Carbon bars can be supplied primed ready for paint or hot dipped galvanised to BS EN 1461 – 2009 all fittings (forks, pins, turnbuckles, couplers and lock covers) are supplied with a galvanised coating.

Fittings are designed to give the maximum amount of flexibility and adjustment, special fittings can be designed to suit customer requirements.

Cast fittings are UT and MPI tested in accordance with European technical approval – ETA21/0053.

Technical literature is available with design calculations and loadings to design code EC3 our technical team is always available to assist with specification, installation and design.

# Stainless Cables

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The Macalloy SC460 is an extension of Macalloy Tension System, available in stainless steel. The cable system utilises the same Macalloy fork end as the accompanying tension structures range of tension bars and compression struts, allowing for combinations of all three systems.

## **Benefits of Macalloy Stainless cables.**

- Can be coiled for transport to reduce cost
- Low maintenance
- Easy to install on-site
- Can be threaded directly into steelwork
- Can be used to span long distances

## Macalloy SC460 Stainless Cable

The cables used permit a conventional elongation. The elongation of the cable length can be between 0.10 and 0.75%, depending on the magnitude and frequency of loading. This must always be considered in the design of the structure.

Macalloy offers three types of cable:

**1X19 SPIRAL STRAND** has moderate initial stretch properties. All the cable adapter fittings are designed to match the minimum breaking load of the 1x19 cable.

**COMPACT STRAND** has a higher breaking load, along with a lower initial stretch, than the 1x19 strand cable and is available in most diameters.

**7x19 STRAND** is the most flexible cable and is ideal where this property is paramount.

## Standard Components SC460 Tendons

The fork and pin components of the system are all made from austenitic or duplex stainless steel. The swaged fittings are factory swaged to both ends of the cable and the strength of the connection exceeds the break load of the cable.

Pin set bodies above SPA24 may be in martensitic stainless steel. The system is designed to match the minimum break load of the 1x19 strand cable.

## Connection Plates

All forks may be connected to either carbon steel or stainless steel connection plates with an equivalent strength to BS EN 10025 grade S275 or Grade 316 to BS 970. Where carbon steel plates are used, isolation sleeves and washers may be required to prevent bi-metallic corrosion.

## Finish

All components are finished in a Grit 220. (N3) polished finish. Other finishes are available on request.

# Compression Struts

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**Macalloy offers two types of compression struts;**

- **Architectural Strut Range**
- **Fixed Compression strut system**

## **Macalloy Architectural Compression Strut**

- The Macalloy Architectural Compression Strut provides an aesthetically pleasing long taper to each end of the compression strut.
- The system uses the same fork end system as the Macalloy tension bar and cable systems, allowing for a successful combination of all three systems.
- Available in either carbon, galvanised or stainless-steel finish, the Architectural Compression Strut comes complete with an adjustable locking collar that provides a seamless link (hiding the thread used to connect the fork) between the fork end and the strut.
- Available in all major CHS (Circular Hollow Section) diameters from 33.7mm to 323.9mm. Custom dimensions are available on request.

### **Benefits of Macalloy Architectural Compression Strut:**

- Can be used in compression, tension and reverse loadings
- An architectural alternative to steelwork
- Adjustable system, allowing for site anomalies and ease of installation
- Circular steel creating optimum strength



### **Macalloy Fixed Compression Strut**

The Macalloy Fixed Compression Strut provides a cost-effective, architectural alternative to the standard finish applied to standard hollow tube sections. The fork is designed with the same critical dimensions as the standard Macalloy fork end, which means it can be used in conjunction with other Macalloy systems.

The Macalloy Fixed Compression Strut is available in carbon steel as standard. A galvanised option is also available.

Standard sizes are available for CHS diameters 33.7mm to 323.9mm. Larger sizes and stainless steel are available as special orders

### **Benefits of Macalloy Fixed Compression Strut:**

- Cost-effective CHS solution
- Available in kit form on request
- Available in a number of finishes
- Compliments the rest of the Tension Structures range

# Post Tensioning

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## Macalloy 1030 and S1030

Macalloy was the first company in the world to develop a post-tensioning bar system. The product has since evolved to include a unique fatigue-resistant thread form that provides low lock-off losses on stressing.

### **Benefits of Post Tensioning Bar:**

- Fatigue resistant thread
- Ideal for pre-stress concrete construction
- Threaded to suit your requirements (fully and end threaded)
- Can be cut to length on site
- High impact resistance
- Used for a variety of temporary and permanent constructions
- Patented Macalloy thread allows low lock-off losses during stressing
- The Macalloy 1030 and S1030 post-tensioning bar systems are high strength with superior fatigue properties. The Macalloy Post Tension bar provides an ultimate yield strength of 1030 N/mm<sup>2</sup>.
- The Macalloy Post Tension bar is available in diameters from 26½ to 75mm and lengths of up to 11.8m. Longer lengths can be achieved by joining bars together with couplers. Custom sizes are available on request.



- The 1030 bar is a carbon chrome steel bar with high strength properties achieved by cold working or heat treatment.
- The stainless-steel version (S1030) is a martensitic nickel-chrome alloy steel, hardened during the manufacturing process. Available in diameters 20 to 75mm and lengths of 6m. again, longer lengths can be achieved by joining bars together with couplers and custom sizes are available on request.
- We can also supply a range of accessories including nuts, washers, end plates and ducts.
- For corrosion protection, Macalloy can supply bars with a factory-applied Denso Tape. This is a grease-impregnated tape, which has technical and cost-saving benefits over traditional duct and grout solutions.

## Foundation Anchor Bolt Solution for on-shore Wind Turbines

- The benefits of using Macalloy bars have been widely recognised across the construction industry, and they are now used extensively for wind turbine projects.
- The high strength Macalloy steel bars, with their excellent fatigue properties, are ideally suited for use as wind turbine anchor bolts, in anchor bolt cages and in onshore concrete gravity-based foundations.
- The Macalloy bar offers technical advantages over the standard 8.8 and 10.9 bolts – and can deliver significant cost savings.
- The Macalloy bar has an ultimate failing load of 1035 N/mm<sup>2</sup> and a fatigue detail category of 80. It can be comfortably stressed to 70% (or even up to 80%) of its failing load during installation.
- The higher strength and fatigue properties allow for smaller diameter, and/or fewer bars to be used in the foundation, saving money on materials as well as installation and maintenance costs.
- The Macalloy bars have excellent relaxation properties and low lock-off losses, helping to reduce installation time and eliminate or reduce the regular need to re-stress bolts after installation.

## Corrosion Protection

- The Denso tape solution provides significant advantages over the traditional duct and heat shrink tubing applications and is a more cost-effective solution. Denso tape provides guaranteed corrosion protection, for well over the usual maximum 30 years design life of an onshore wind turbine.
- We can offer duct and accessories for grouting purposes, and also offer alternative solutions for corrosion protection of exposed ends.
- For more details on the bar diameters, failing and proof loads, fatigue performance, contact our technical team or download our brochure.

# S650 Stainless Threaded Bar

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This development of the stainless-steel anchor system matches the requirements of modern anchor design, whilst giving you the benefit of Macalloy's world- beating technical support and international distribution network.

## **Benefits of Macalloy S650:**

- Stainless-steel, fully-threaded, corrosion-resistant anchor for use as soil nail, rock bolts or ground anchor
- Robust, cold-rolled thread prevents site damage during installation
- High-strength 316 stainless steel providing exemplary corrosion resistance
- Standard fittings in stainless steel, bespoke sizes available

## **Ideal for a wide range of applications:**

- Embankment stabilisation
- Tunnelling
- Underpinning
- Mini Piles
- Seismic
- Wind turbines

S650 is a natural development of the Macalloy bar systems, providing a high-quality, high-strength, fully-threaded stainless steel bar for use in geotechnical and concrete applications.

S650 combines the benefits of Macalloy coarse thread with the high durability and performance of stainless steel. It is available in sizes from 16mm to 50mm, ensuring that the full range of applications are covered.

The bar performs equally well as a rock bolt, soil nail, holding down bolt or mini pile. Manufactured from high-strength stainless steel with a minimum characteristic yield strength of 650N/mm<sup>2</sup>, it is available in 316. The coarse thread has exceptional bond characteristics, which combine with the full-strength nuts to provide a high-capacity anchor system.

The durability of stainless steel is well-documented, Macalloy Stainless S650 really is a 'fix and forget' solution.

Macalloy's unique manufacturing facilities allow this bar to be produced in standard 6m lengths. However, longer lengths may be available on request.

# Sheet Piling Tie Bar

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The Macalloy Sheet Piling Tie Bar System is available in four different yield strengths from 460 to 700N/mm<sup>2</sup>. Thread Diameters from M42 to M105 are available as standard, with larger thread diameters available as special order.

## **Benefits of Macalloy Sheet Piling Tie Bar System:**

- Ideal for use in retaining wall applications and marine environments
- Cold rolled thread to reduce potential crack propagation
- In-house application of Denso coating and protection
- Variety of bespoke fittings to suit most applications

Bars come in lengths of to 11.8 metres. Longer lengths can be achieved through the use of couplers, turnbuckles or other joints.

For corrosive environments, Macalloy can provide a range of protection solutions including galvanising and Denso Tape is a grease-impregnated tape which offers technical and cost advantages over traditional duct and grout or sacrificial corrosion methods.

We also offer a complete range of accessories.

## Plates

- Washer plates
- Bearing plates
- Anchor plates
- A wide range of bespoke plates

## End Terminations

- Standard Nut, Washer and Plate end anchorage
- Spherical nut anchorage
- Fork and/or spade connections

## Joints

- Articulated joints
- Turnbuckles and couplers

### **Product names in this range relate to the yield strength:**

- TB460 – 460N/mm<sup>2</sup> yield strength
- TB520 – 520N/mm<sup>2</sup> yield strength
- TB590 – 590N/mm<sup>2</sup> yield strength
- TB700 – 700N/mm<sup>2</sup> yield strength

Higher capacity bars are available on request.

## Waling Bolts

Waling Bolts are used to connect a waling beam to a sheet piling wall. Waling bolts are available in all standard metric thread diameters up to M105 and are available in strengths to match your tie bars.

# Site Services

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From your first design to project completion, our team of experienced engineers are on hand to answer your technical enquiries, assist with your project and develop solutions tailored to your specific needs.

## **Benefits of Macalloy Site Services:**

- Using Macalloy trained engineers
- Comprehensive records provided on completion
- Installation assembly guides available
- Worldwide assistance
- Bespoke Techno-Tensioner for increased accuracy and higher loading
- Tailored training to meet your project requirements
- CSCS Site approved operatives
- Installation supervision Load testing

## **Equipment Hire & Purchase**

Macalloy can provide equipment to support product stressing, including strap wrench, chain wrench and hydraulic jacks and the Macalloy Techno-Tensioner.

## **Technician Site Visits**

We can provide on-site personnel to carry out tensioning of all Macalloy products. We can also deliver on-site training for this.

## **Support**

We provide assembly and installation instructions for all our products, as well as stressing records for onsite use. Further guidance and support can be provided, and we can also develop bespoke systems for stressing any 'out of the ordinary' structures.

## **Installation**

We offer installation for tension rods and cables. Our team carry out a pre-site visit to discuss feasibility, risk assessment and sequencing.

# Glulam, Cross Laminated Timber (CLT) and Timber Structures

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Glulam is an abbreviated term that stands for glue-laminated timber (GLT). A glulam is a structurally engineered product made up of several layers of solid wood, bonded together with a special adhesive to form a solid, single unit.

Many Architects have used this material in their designs as its application is versatile, has advantages over using traditional materials, and is aesthetically beautiful in appearance.

It is also:-

- Very efficient to produce
- Has superior earthquake resilience
- Highly resistant to fire
- Adjustable
- Lightweight compared to traditional building materials enabling ease of installation
- Has a variety of colour ranges
- Has a credible sustainable carbon footprint
- Suitable for many structural applications as it can be manufactured straight or curved
- Used for large section sizes and long lengths.



## Macalloy involvement in Glulam and CLT structures

Macalloy are involved in all aspects of the design, manufacture, and supply of tension rods and fittings for use in glulam timber structures.

Our Macalloy product range, used in glulam and timber structures includes:

- Macalloy 460, 520 and 550 architectural bars systems
- Cross couplers
- Turnbuckles
- Connection discs

We have extensive experience and knowledge of working with contractors, engineers and architects and steel erectors.

Steel tension rods solve the age-old problem of roof construction; they prevent the walls from splaying out as the roof is loaded with wind or snow. The exceptional strength of glulam makes it well suited for use in the load-bearing structures of buildings with long spans when an architectural natural finish is required. The rods can even be concealed within the timber truss members. By doing this, the large tensile loads can be resolved. Versatility is a key feature of Macalloy products, but Macalloy architectural systems complement the design of the stunning features of glulam architecture.

# Projects

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# Airports

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## Dubai International Airport, UAE

**Background:** The second terminal is capable of handling 15 million passengers, allowing the airport to handle 89.1 million passengers a year, ranking the third busiest airport in the world. Dubai International manages connections between 260 destinations worldwide and employs more than 90,000 in the main airport.

**Macalloy involvement:** A series of tie rods and tension bars were used in the construction of this suspended concourse, built purposely to link two areas of the airport together. The products supplied by Macalloy were integral to the airport design.

Macalloy tie rods are used to suspend a concourse linking two terminals. The whole structure is suspended by Macalloy tie bars from two steel stations. The site services team were required for on-site stressing of the tension bars, to oversee correct installation. Macalloy tension bars are also used as bracing within the steel structure.



## Kuwait International Airport, Farwaniya Kuwait

**Background:** This VIP Plaza is used for outdoor ceremonies and features a large membrane roof. Macalloy tension bars are used to tension the roof.

**Macalloy involvement:** The tie bars are used as backstays which rise from the main upright posts to the centre, providing support for the large span roof . The membrane structure of the VIP Ceremonial Plaza has a span of 84.7m x 46m between the two arches, and the height of the masts are 32.2m.



## Malaga Airport, Spain

**Background:** The new terminal 3 covers 250,000 square meters. Inaugurated in March 2010 by King Juan Carlos it represents an important addition to this busy southern Spanish airport.

**Macalloy involvement:** Macalloy tension bars are used to support the large glass facade walls. The tie rods are used both as bracing for the large steel frame structure, and feature horizontally to provide structural support to the actual glass.

## Singapore Changi Airport, Singapore

**Background:** Changi Airport is a major international hub serving Singapore and one of the world's busiest airports managing nearly 70 million passengers. The Changi Airport Terminal connects passengers to the extended subway line, providing a pedestrian link between two of the airports three terminals.

The Airport has won multiple awards including:

- Singapore Building and Construction Authority – Construction Excellence Award
- AIA – New York City Chapter – Design Award Architecture
- World's Best Airport on numerous occasions

**Macalloy involvement:**

Tie Rods were used to support the glass façade. Macalloy manufactured a range of bespoke components for this installation including a cable clamp and crossover node that, allowed a tie bar to pass through the node. The node was also designed to enable minimal movement on the bar.



# Stadia

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## Khalifa Stadium, Doha, Qatar

**Background:** This magnificent Stadium is one of many hosting the 2022 FIFA World cup in Qatar. Originally built in 1976, it has subsequently had two major renovations. Firstly, in 2005 doubling its seating capacity for the Asian Games, and later in 2016 undergoing major redevelopment.

**Macalloy involvement:** Macalloy supplied 460 Tension Rod Systems in M76 +M90 used to brace the structure as well as customized Pin sets ranging from 80mm diameter to 330mm. The Macalloy Techno-Tensioner was used on site with Technical support to stress the Tie Rods.



## O2 Dome Prague, Czech Republic

**Background:** A leading European Arena located 10km outside of Prague. Its modern facilities and technology have a capacity of 20,000 spectators.

**Macalloy involvement:** Tie Bars are used to tension the lightweight steel truss roof which has a span of 135m. After the initial design stage, the roof had to undergo a re-design as part of cost-saving measures.

The original thick section steel truss roof was re-designed to a thinner section steel truss roof, tensioned with Macalloy Tie Rods around a central wheel. This saved around 400 tonnes of materials and reduced the roof weight by about 30%. This re-design and other cost savings enabled the project to be completed.



## Tottenham Hotspur Stadium, London

**Background:** Tottenham Hotspur Stadium is the home of Premier League club Tottenham Hotspur in North London, replacing the club's previous stadium, White Hart Lane. With a seating capacity of 62,850, it is the third-largest football stadium in England and the largest club stadium in London.

Awarded 'Project of the Year' in 2019, the ground-breaking new stadium has a retractable pitch, allowing it to hold non-football events such as NFL games (American Football), on an artificial pitch.

**Macalloy Involvement:** The club's new home, which overlaps some of the old site, has used both Macalloy Post Tensioning and Tension Structures products. Stainless 1030 P/T bar in 32mm and 50mm along with fittings, were used within the ground construction, while M42 Tension Bars in 520 grade with disc connections were used for bracing within the structure.





# Bridges

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## Sheikh Zayed Bridge, Abu Dhabi

**Background:** Completed in 2010 this arched bridge is designed in a wave form that forms a stunning silhouette across the channel, joining Dubai to the island of Abu Dhabi. It is 824m long and features a complex, but beautiful Illumination of lights across the whole of the bridge.

**Macalloy's Involvement:** The Macalloy 1030 Post Tensioning Bars are used as anchor bolts to anchor the large steel arches. The bridge's eight lanes (four in each direction) allow 16,000 vehicles to pass per hour. The architect, Zaha Hadid was the first woman to win a Pritzker Prize, the architectural world's most important honour.



## Golden Jubilee Bridge, London

A collection of Macalloy Tie Rods and Post Tension Bars went into making a truly iconic bridge which forms part of London's modern architectural landscape.

**Background:** After years of having a reputation of being narrow and dangerous, the decision was made to replace the footbridges that ran either side of the Hungerford Bridge in London, with new structures. The bridges connect Charing Cross and Embankment stations to the north and Waterloo on the south. A competition was launched in 1996 to design two new footbridges. Its new pedestrian walkways were renamed The Golden Jubilee Bridge to commemorate Queen Elizabeth II's ascension to the throne on her 50th anniversary. They run on both sides of the Hungerford Bridge. The complex design by architect Lifschutz Davidson won the Royal Fine Art Commission's "Building of the Year Award" in 2003.

**Macalloy's Involvement:** Both the Macalloy 460 and 1030 bar systems were critical in the building of the two 4m wide bridges, which were considered as an engineering challenge. The tendons were employed as deck and backstays, with roughly 180 Macalloy 460 Tie Rods throughout the deck, and the backstays were placed under tension. Furthermore, M125 threaded tendons have been used to produce single node points, restraining up to four M64 backstays. As trunnion restraints and holding down bolts, Macalloy 1030 Post-Tensioning Bars were utilised.

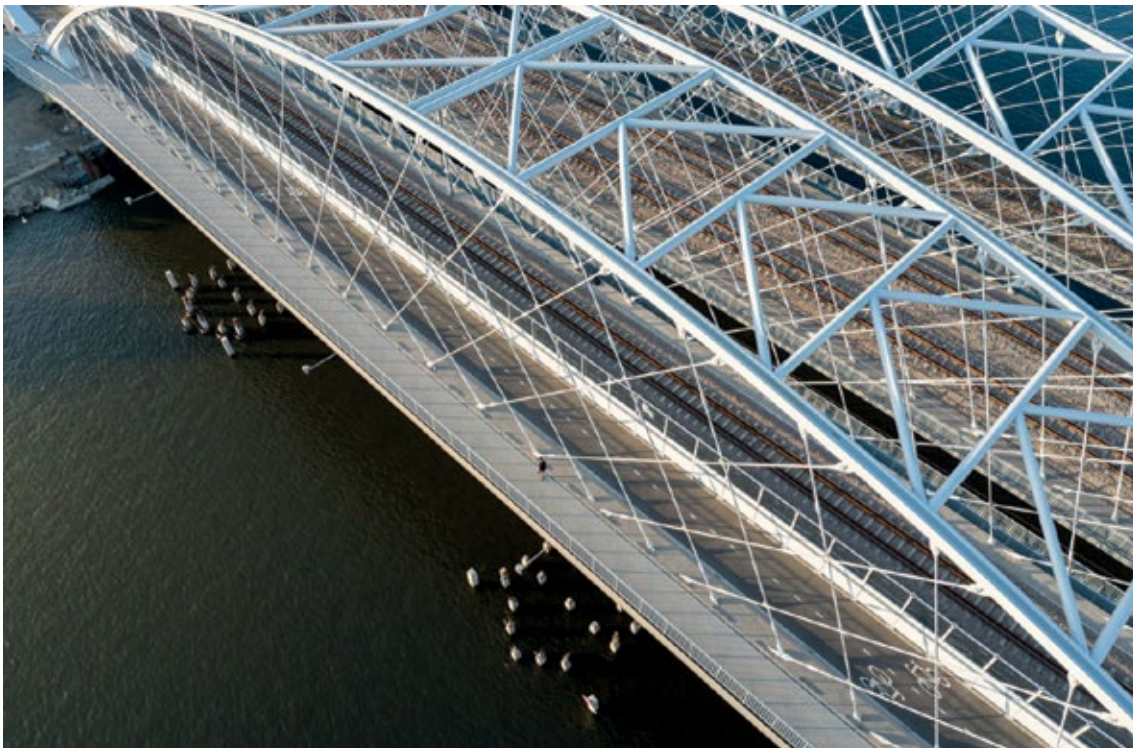


## Kraków Bridge, Poland

**Background:** The E30 railway line is an important passenger and freight route, and part of the pan-European transport corridor that connects Ukraine with Poland and Western Europe.

As part of a wider investment programme, the line between the Kraków Główny and Kraków Płaszów stations was earmarked for modernisation to bring it up to international standards. The new railway, pedestrian and cycle pathway bridge is over the Vistula River in Krakow. Comprising of nine arches, the bridge utilises the unique “lattice” design first introduced in the Troja bridge project to reduce the arch height and give a more slender appearance.

**Macalloy involvement:** Completed in 2023 with the Austrian contractor Strabag, this structure featured M76, M85 and M90 tendons which successfully passed a fatigue test to Detail Category 84 and Stress Range of 104MPa.



# Glulam and Timber

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## Scottish Parliament, Edinburgh

The iconic Scottish Parliament building at Holyrood is home to the Scottish Parliament. This purpose-built structure houses over a thousand MSPs, staff and civil servants. Its design reflects the landscape, people and culture of Scotland and is constructed from steel, oak and granite.

**Macalloy involvement:** Macalloy 460 in diameters M10 to M56 and lengths of 6m for M64 and M76 were used to help support the roof within the Scottish Parliament Building, which was designed by Enric Miralles, and completed in 2004.



## Bently Heritage Distillery, Nevada, USA

**Background:** This stunning estate distillery is in Nevada, United States of America. The complex has been completely renovated using the original materials, and with sustainability as part of their vision, the buildings have been awarded a LEED Gold certificate level.

They are embracing both old and new techniques in their processes.

It has an old Flour Mill, used today as a Public House and Distillery. A creamery which processes locally grown products, a ranch malting facility, and two rickhouses that store the barrels. It produces vodka, gin whiskey, and liqueur. The ranch is set on many acres of land and cultivates its own barley. The project took five years to renovate and was awarded the American Institute of Architects Honor (AIA) in 2019.

**Macalloy involvement:** This was a great project to be involved in given it's dedication to using sustainable materials and preserving original source materials. The timber beams which are used in construction are supported by Macalloy tie rods. A stunning example of how modern materials can blend in with older designs. Macalloy cross couplers have been used here to connect the tie bars that brace the structure. The cross couplers are in stainless steel, working in perfect contrast with the black coloured Macalloy bars. A unique way to combine colours against the timber frame.



# Other

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## Burj Al Arab Hotel, Dubai

**Background:** The Burj Al Arab is a luxury hotel and one of the most iconic buildings in Dubai, United Arab Emirates. It is the seventh tallest building in the world, although 39% of its total height is made up of non-occupiable space. Burj Al Arab stands on an artificial island 280 m from Jumeirah Beach and is connected to the mainland by a private curving bridge. The shape of the structure is designed to resemble the sail of a ship.

**Macalloy involvement:** Macalloy Architectural Post Tension Bars/Tension Rods were used to secure the vertical steel columns of the Burj Al Arab Hotel. 75mm diameter Macalloy 1030 Post Tensioning Bars were used as anchor bolts.

The building also features a fabric membrane wall, and Macalloy Architectural Tie Bars were used to tension the membrane structure in the building.



## The Saipan Dragons, Saipan

**Background:** The stunning Saipan Dragons live in the lobby of the Imperial Palace in Saipan, the largest of the Northern Mariana Islands, which is a commonwealth of the United States in the western Pacific Ocean.

Spanning over 60 metres and weighing 40 tonnes, the sculpture features two flying dragons which are made of stainless steel and gold, and studded with an incredible 2.5 million crystals.

Made by the Czech design and glassmaking company LASVIT, the installation fits into the overall design concept created by DSAA architects.

**Macalloy involvement:** The Dragons, who appear to be in mid-flight, are of course suspended proudly on Macalloy Stainless SC460 cables.



## Esplora Interactive Science Museum, Kalkara, Malta.

**Background:** The history of the Esplora Interactive Science Centre located in Kalkara Malta, is quite extraordinary. The main building dates back to the 17th Century which was originally built as a private residence. It has served as a hospital in many wars including World War I & II. Today the building serves the public for a different reason. It is a popular educational and recreational destination that aims to engage visitors, especially children and families, in hands-on and interactive science exhibits.

**Macalloy involvement:** Macalloy has supplied M42 and M76 tendons used on the planetarium exhibit.





# Macalloy & Tekla Software

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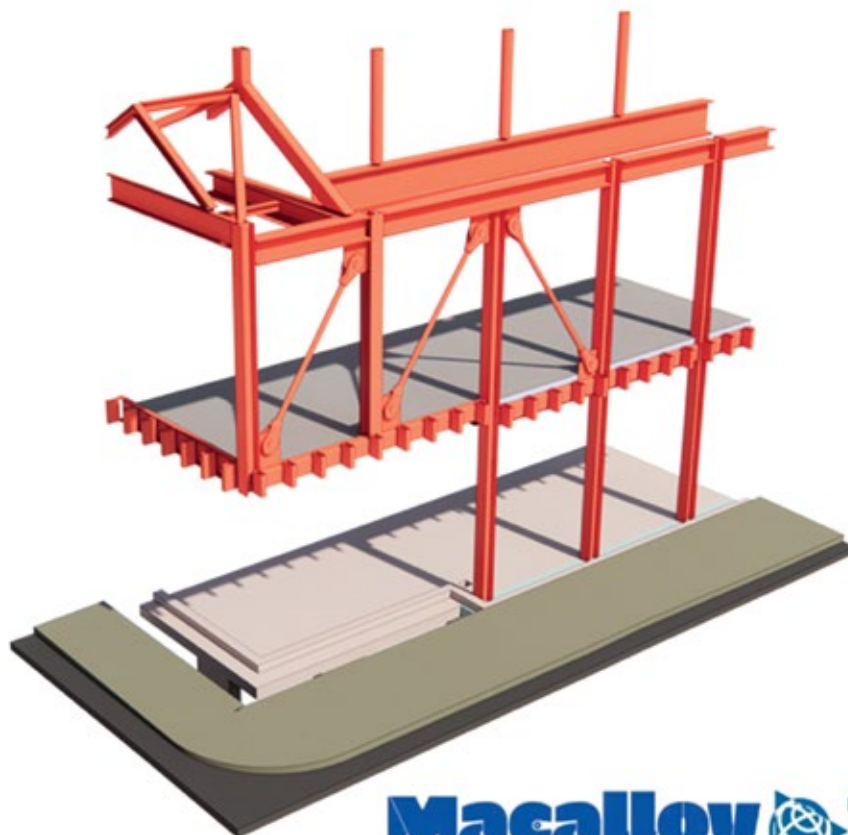
## Macalloy Tension Structures range (BIM) in Tekla Software

Macalloy has been working closely with Trimble, an industrial Technology company, to develop BIM models for our tension rod and compression strut range for use with Tekla software.

With the increasing prevalence of Building Information Models (BIM) being used in the building process, Macalloy has developed its architectural tension rods and compression struts into BIM objects.

Macalloy BIM objects are designed specifically for use with Tekla Structures, these native objects offer the designer easy snap-to points and the latest functionality.

Available for download on the Macalloy website and Tekla warehouse.



**Macalloy**  **Trimble**  
Threaded Bar Systems Trusted Worldwide

The Tekla structure models for Macalloy architectural tension rods and compression struts.

- Apply multiple components along the length of the architectural tension rod.
- Define the position of the turnbuckle, turnbuckle fin plate, coupler, and cross coupler.
- Define the maximum length of the tension rod and compression struts to prevent incorrect design specifications. When the system limitations are exceeded, the components turn red.
- Enables Engineers to specify the material type for both the tension rod and compression strut range.
- Create an accurately configured design at the start of the design process.
- Efficiency in design, offers cost savings.
- Apply an approximate weight to all Macalloy BIM objects which are then itemised on the product report.
- The connection disc and cross coupler angles are also restricted between 40-140 degrees, reverting to the closest acceptable configuration if an angle is chosen outside of the range.

### **Which Macalloy products are available on Tekla?**

Macalloy 550 architectural tension rods (M10-M120), and Compression struts (M12-M100), all available in a Galvanised, Carbon or Stainless finish.

# Contacts

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# Certification



## CERTIFICATE OF CONFORMITY OF THE FACTORY PRODUCTION CONTROL

**0809-CPR-21004864**

In compliance with *Regulation 305/2011/EU of the European Parliament and of the Council of 9 March 2011* (the Construction Products Regulation or CPR), this certificate applies to the construction product

### Execution of steel structures

Welded steel structures intended for structural use in construction works.  
Execution classes: up to and including EXC3  
Declaration methods: 1 and 3a

placed on the market under the name or trade mark of

#### **McCalls Special Products Ltd t/a Macalloy**

Caxton Way  
Dinnington S25 3QE  
United Kingdom

and produced in the manufacturing plant

#### **McCalls Special Products Ltd t/a Macalloy**

Caxton Way  
Dinnington S25 3QE  
United Kingdom

This certificate attests that all provisions concerning the assessment and verification of constancy of performance described in Annex ZA of the standard

**EN 1090-1:2009+A1:2011**

under system 2+ are applied and that

**the factory production control is assessed to be in  
conformity with the applicable requirements.**

This certificate was first issued on October 13, 2021 and will remain valid as long as neither the harmonised standard, the construction product, the AVCP methods nor the manufacturing conditions in the plant are modified significantly, unless suspended or withdrawn by the notified factory production control certification body. The validity of the certificate may be confirmed at the web address [www.sertifikaattihaku.fi](http://www.sertifikaattihaku.fi).

Espoo October 13, 2021



Katja Vahtikari  
Manager, Certification & Inspection



Tiina Ala-Outinen  
Manager, Building Structures

## CERTIFICATE OF CONSTANCY OF PERFORMANCE

**0809-CPR-21005809**

In compliance with *Regulation 305/2011/EU of the European Parliament and of the Council of 9 March 2011* (the Construction Products Regulation or CPR), this certificate applies to the construction product

### **Macalloy 1030 Post-Tensioning System**

post-tensioning kit for an internal bonded or unbonded tensioning system

placed on the market under the name or trade mark of

### **McCalls Special Products Ltd t/a Macalloy**

Caxton Way  
Dinnington S25 3QE  
United Kingdom

and produced in the manufacturing plant

### **Macalloy Ltd**

Caxton Way  
Dinnington S25 3QE  
United Kingdom.

This certificate attests that all provisions concerning the assessment and verification of constancy of performance described in

### **ETA 21/0054**

issued on 01/01/2021

and

### **EAD 160004-00-0301**

under system 1+ for the performance set out in the ETA are applied and that the factory production control conducted by the manufacturer is assessed to ensure the

### **constancy of performance of the construction product.**

This certificate was first issued on December 13, 2021 and will remain valid as long as neither the ETA, the EAD, the construction product, the AVCP methods, nor the manufacturing conditions in the plant are modified significantly, unless suspended or withdrawn by the notified factory production control certification body. The validity of the certificate may be confirmed at the web address [www.sertifikaattihaku.fi](http://www.sertifikaattihaku.fi).

Espoo December 13, 2021



Tiina Ala-Outinen  
Manager, Structures



Samuli Korkiakoski  
Assessor

# CERTIFICATE OF CONFORMITY OF THE FACTORY PRODUCTION CONTROL

**0809-CPR-21005810**

In compliance with *Regulation 305/2011/EU of the European Parliament and of the Council of 9 March 2011* (the Construction Products Regulation or CPR), this certificate applies to the construction product

## **Prefabricated tension rod system**

Tension rod systems Macalloy 355, 460, S460, 520 and S520

placed on the market under the name or trade mark of

## **McCalls Special Products Ltd t/a Macalloy**

Caxton Way  
Dinnington S25 3QE  
United Kingdom

and produced in the manufacturing plant

## **Macalloy Ltd**

Caxton Way  
Dinnington S25 3QE  
United Kingdom.

This certificate attests that all provisions concerning the assessment and verification of constancy of performance described in

**ETA 21/0053**

issued on 01/01/2021

and

**EAD 200032-00-0602**

under system 2+ are applied and that

**the factory production control is assessed to be in conformity with the applicable requirements.**

This certificate was first issued on December 29<sup>th</sup>, 2021 and will remain valid as long as neither the ETA, the EAD, the construction product, the AVCP methods, nor the manufacturing conditions in the plant are modified significantly, unless suspended or withdrawn by the notified factory production control certification body. The validity of the certificate may be confirmed at the web address [www.sertifikaattihaku.fi](http://www.sertifikaattihaku.fi).

Espoo December 29<sup>th</sup>, 2021



Katja Vahtikari  
Manager, Certification & Inspection



Samuli Korkiakoski  
Assessor



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Bucknalls Lane  
Watford  
Hertfordshire WD25 9BA  
T 01923 665300  
clientservices@bbacerts.co.uk  
www.bbacerts.co.uk

This is to certify that the Management Systems operated by:

**McCalls Special Products Ltd t/a Macalloy**

Caxton Way  
Dinnington  
Sheffield  
S25 3QE

for the Production of plain round and deformed pre-stressing bar, stainless bar and pre-stressing anchorages for post-tensioning systems and development. Production and threading of steel bar. Production and supply of machined and threaded mechanical fittings, has been assessed and registered by the BBA as meeting the requirements of:

**BS EN ISO 9001 : 2015 Quality Management Systems**

Signed on behalf of the British Board of Agrément:

Date of original issue: 18 September 2018  
Date of Second issue: 17 September 2021  
Expiry date: 17 September 2024

A handwritten signature in black ink, appearing to read 'Giesler', written in a cursive style.

Hardy Giesler  
Chief Executive Officer



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# OVAKO

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We, Ovako Bar AB hereby certify that the following steel grades 3M and 18M, supplied to Macalloy, contains a minimum of 97% recycled material and the remaining 3% consists of ferro alloys.



Pia Ström  
Technical Customer Support & Product Development



2016-11-08 Boxholm

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## Ovako Bar AB

Postal address: SE-777 80 SMEDJEBACKEN, Visitors address: Smedjebacken, Sweden  
Tel. Int. +46 240 66 80 00, Fax. Int. +46 240 743 62  
[www.ovako.com](http://www.ovako.com)  
Reg. No: SE5560905102, Reg. Office: Smedjebacken

To: Whom it may concern

## Carbon dioxide intensity for hot rolled bars for McCalls from Ovako Bar AB (SmeBox)

Ovako provides Greenhouse gas emissions data<sup>1</sup> (in the form of carbon dioxide equivalents - CO<sub>2</sub>e) for its customers. This data is presented in different forms, since it is used for different purposes. As a point of caution, it is very important when comparing CO<sub>2</sub>e data for a given product, to only compare it with data calculated in exactly the same way and with the same sources included.

Ovako's goal is to achieve zero carbon emission steel with zero greenhouse gas<sup>1</sup> emissions in scope 1 and 2. In addition, beginning in January 2022 and until the goal is achieved, the company will counterbalance the remaining greenhouse gas emissions in all its operations through carbon offsets. The use of offsets will gradually decrease as Ovako continues to invest in new technology and improve its processes. The purpose of the offsets is to reduce global carbon emissions, thereby contributing to the transition toward a sustainable society.

### OVAKO CARBON DIOXIDE INTENSITY AND AVERAGE FOR STEEL INDUSTRY

#### *Carbon intensity for the specific products;*

- 18M, hot rolled bars from Smedjebacken (Ø53 – 100 mm), straightened
- 18M, hot rolled bars from Boxholm (Ø13- 52 mm), straightened
- 3M, hot rolled bars from Boxholm

#### A. CO<sub>2</sub>e from steel making per tonne of crude steel

- Calculated according to EU ETS<sup>2</sup>.
- Includes the steel-making process.

Product	Steel Mill	Steel making, carbon neutral <sup>3</sup>	Steel making, without carbon offsets <sup>3</sup>	Global average for steel making <sup>4</sup>	Unit
Products for McCalls	Smedjebacken	0	60	1700	kg CO <sub>2</sub> e/tonne crude steel

<sup>1</sup> Greenhouse gas emissions according to Greenhouse Gas (GHG) Protocol and ISO14064. Greenhouse gases emitted from Ovako are carbon dioxide and air-conditioning gases (Chlorofluorocarbons).

<sup>2</sup> The European Union Emissions Trading System.

<sup>3</sup> Data for the year 2020.

<sup>4</sup> Estimations from available data.

**B. CO<sub>2</sub>e footprint “cradle to gate” for a hot rolled bar / Environmental Product Declaration (EPD<sup>5</sup>)**

- Based on an LCA<sup>6</sup> for hot rolled bar and calculated according to ISO 14044 and PCR 2015:03. Published as an Environmental Product Declaration EPD.
- Includes all recycled scrap, alloying elements, transport, energy and waste products in the production process as well as the footprint of incoming goods and services and the full yield loss in production.

Product	Production site	CO <sub>2</sub> e footprint , carbon neutral <sup>7</sup>	CO <sub>2</sub> e footprint , without carbon offsets <sup>7</sup>	Global average <sup>8</sup> hot rolled bar	Ore based average <sup>9</sup>	EU EAF average <sup>9</sup>	Non-EU EAF Average <sup>9</sup>	Unit
Products to McCalls	Smedjebacken / Boxholm	177	389	2690	3300	1000	1300	kg CO <sub>2</sub> e / tonne of hot rolled bar

**C. CO<sub>2</sub>e footprint “cradle to gate” for a specific product**

- Calculated by the Ovako Carbon Calculator<sup>10</sup>, based on LCA<sup>4</sup> for hot rolled bar, primary data for further processing, the effects of the different alloy content in each steel grade and the yield effects.
- Includes all further processing and effects from steel grade as well as recycled scrap, alloying elements, transport, energy and waste products in the production process as well as the footprint of incoming goods and services and the full yield loss in production.

Product	Production unit	CO <sub>2</sub> e footprint carbon neutral <sup>11</sup>	CO <sub>2</sub> e footprint without carbon offsets <sup>11</sup>	Global average specific product	Unit
18M	Smedjebacken (steel plant, rolling and straightening)	185	374	Not available	kg CO <sub>2</sub> e / tonne hot rolled bar
18M	Smedjebacken (steel plant) + Boxholm (rolling and straightening)	187	440	Not available	
3M	Smedjebacken (steel plant)+ Boxholm (rolling)	184	425	Not available	

<sup>5</sup> An Environmental Product Declaration (EPD<sup>®</sup>) is a verified and registered document that provides transparent and comparable information about the environmental impact of products over their life cycle. [www.environdec.com](http://www.environdec.com).

<sup>6</sup> LCA; A life cycle assessment for Ovako hot rolled bar by RISE institute, in accordance with ISO 14044 (ISO 2006).

<sup>7</sup> Data for the year 2019, based on LCA for hot rolled bar and published in EPD

<sup>8</sup> Estimates, read more in Ovako Technical report <https://www.ovako.com/en/sustainability/environment/>

<sup>9</sup> Estimates from available data

<sup>10</sup> Ovako Carbon calculator reviewed and approved by RISE

<sup>11</sup> Data for year 2020 from Ovako Carbon Calculator

**D. CO<sub>2</sub>e footprint “gate to gate” for a specific product**

- Calculation for best practice with 20 000 kg by truck

From site	To	Transport mode	Calculated best practice	Unit
Smedjebacken	Dinnington, Rotherham, UK	Truck	74	WTW <sup>12</sup> kg CO <sub>2</sub> e / tonne gate to gate
Boxholm		Truck	62	

More information on Ovako’s climate ambitions and the path to zero carbon emissions is available on [www.ovako.com](http://www.ovako.com).

On behalf of OVAKO

Katarina Kangert  
Head of Sustainability  
Ovako Group

**Attachments**

1. Ovako Declaration of Carbon Neutral Production
2. Environmental Product Declaration for a hot rolled bar

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<sup>12</sup> Well-to-Wheel; the CO<sub>2</sub>e emissions from fuel production and vehicle use

In accordance with ISO 14025 for:

# HOT-ROLLED BAR STEEL PRODUCT IN SMEDJEBACKEN & BOXHOLM, OVAKO

<b>Program</b>	<b>The International EPD® System <a href="http://www.environdec.com">www.environdec.com</a></b>
Program operator	EPD International AB
EPD registration number	S-P-01136
Publication date	2017-11-28    Version 2020-10-28
Validity date	2025-10-27
Geographical scope	Global. The production site is Smedjebacken and Boxholm, Sweden



## General information

### Information about the organization

**Owner of the EPD:** Torbjörn Sörhuus  
Tel: +46 240 66 83 55  
[torbjorn.sorhuus@ovako.com](mailto:torbjorn.sorhuus@ovako.com)  
Ovako Bar AB  
777 80 Smedjebacken, Sweden

**Description of the organization:** Ovako is a producer of high-performance engineering steel, with sustainability as a core element of its business.

**Product-related or management system-related certifications:** Certified compliance with ISO 9001, ISO 14001, ISO 50001 and IATF 16949-certificates.

**Name and location of production site:** Smedjebacken and Boxholm, Sweden

## About the company

Ovako is a leading European producer of high-performance engineering steel, with sustainability at the core of all its activities. Ovako serves customers in the bearing, transport and general manufacturing industries. Ovako's customers are found mainly in the European engineering industry and its subcontractors. The steel production is based on scrap, making Ovako the largest recycler in the Nordics. Customers are generally leading manufacturers in their segments, and they place high demands on the performance of their steel.

Ovako belongs to the Nippon Steel Group, together with Sanyo Special Steel. This has formed a strong, world-leading collaboration in specialty steels, with expertise, products and support combined in a global offering. Optimized global production and the joint strength of R&D resources is helping to further accelerate innovation and competitiveness.

Steel melting and casting and modern hot-rolled bar operations are part of the operations at the Smedjeback-

en and Boxholm sites. This includes rolling mills and processing plant in Boxholm and the steel and rolling mill in Smedjebacken. The steel mill in Smedjebacken provides daily deliveries of steel to Boxholm.

The customers are found in many industries, from agriculture and rail to automotive. The majority of the output consists of high wear resistance steel, spring steel and micro-alloyed steel. Flat bar steel is a speciality and accounts for about half of the bar steel manufacturing.

WR-Steel®, the name for wear-resistant steel, is an important product from Smedjebacken and Boxholm. It is designed to provide a wear-resistant advantage when making products exposed to a high degree of wear and where service life is important. The WR-Steel mission is to optimize the wear resistance of end products. But at the manufacturing stage, it also gives customers the flexibility to form, shape and weld the steel to fit precise engineering needs.



## Product information

**Product name:** Hot-rolled bar steel product

**Product identification:** The product is made from Carbon Steels and Low Alloyed Steels. These steels are in the massive product forms; semi-finished bar products. They are marketed under Ovako's trademarks, attribute brands and EN grade designations, as well as with designations according to various international and national standards.

**Product description:** The declared unit is 1 tonne (1000 kg) of hot-rolled bar steel product at Ovako's gates from the production sites in Smedjebacken or Boxholm. With respect to alloying content, the product represents an average product from the sites. The average consists of different steel qualities with alloying content varying according to the Content Declaration below.

Ovako hot-rolled bars from Smedjebacken and Boxholm are available in the following profiles and dimensions:

- Round bars: 14-120 mm,
- Flat bars: width 15-300 mm, thickness 5-80 mm
- Special profiles: adapted to customers requirements

The bars are characterized by close tolerances, excellent straightness as well as roundness, good surface finishes and low decarburization.

**Process description:** As shown in the illustration below, the main inputs to the steel making process are scrap, alloys, coal, lime, electrodes, fuels, oxygen and inbound transportation.

Scrap is melted in the electric arc furnace, alloyed in the ladle furnace and cast into billets in the Smedjebacken steel mill. This site is closely connected by railroad to the rolling operations in Boxholm. Around half of the steel produced in Smedjebacken is rolled on site, while the remainder is shipped each day for rolling at the Ovako facility in Boxholm.

Major additional processes include waste and slag handling and treatment of wastewater. The production units are equipped with filters that reduces emissions to air.

**UN CPC code:** 412

**Geographical scope:** Global

## LCA information

**Functional unit/ declared unit:** 1 tonne (1000 kg) of hot-rolled bar steel product.

**Reference service life:** Not applicable.

**Time representativeness:** Production data are from 2019.

**Database(s) and LCA software used:** Ecoinvent 3.6 as applied in SimaPro 9.1.0.11, 2020. For calculation of environmental impacts, the method EPD (2018) Version 1.01 in SimaPro was used.

**Description of system boundaries:** Cradle-to-gate

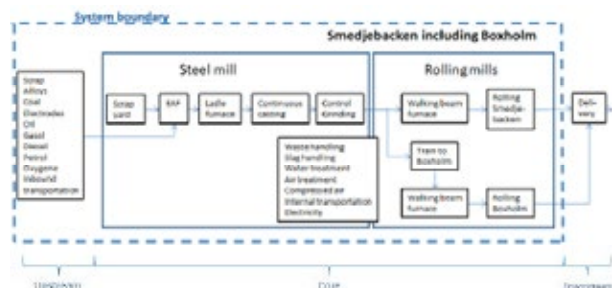
**Cut-off criteria:** Cut-off allocation of waste burdens and benefits in accordance with the polluter pays principle as stipulated in the PCR. Raw material inflows less than 0.0003% of the output flow were disregarded unless there were reasons to suspect significant environmental impact. Core process data is from site production records and therefore of good quality.

**Excluded lifecycle stages:** The use and end-of-life stages are excluded since hot-rolled bar steel products can be used in many different applications which also affect end-of-life.

**More information:** For more information on the product and Ovako steel products, see [www.ovako.com/en/](http://www.ovako.com/en/)

**Name and contact information of LCA practitioner:** Mats Zackrisson at RISE IVF AB has carried out the underlying LCA study. [Mats.Zackrisson@ri.se](mailto:Mats.Zackrisson@ri.se)

**Additional information:** Vattenfall's unspecified electricity mix (16 gram CO<sub>2</sub>eq/kWh) is used for melting and rolling operations. Liquefied petroleum gas (LPG) and oil are used for heating operations.



# Content declaration

## Products

Materials/Chemical substances	[kg/tonne]	%	Environmental/hazardous properties
Iron	Balance	Balance	
Nickel	0.30-15.7	0.03-1.57	Nickel is classified in EC Directive 67/548/EEC as a suspect carcinogen (category 3 – R40) and as a skin sensitizer (R43).
Chromium	0,4-13,1	0,04-1,31	
Molybdenum	0.1-5.8	0.01-0.58	
Manganese	2,3-16,8	0,23-1,68	
Silicon	0.4-19.7	0.04-1.97	

Standards describing the methods used for chemical composition analysis are: ASTM E 415-17 and ASTM E 1019-18.

Steel products are considered as articles under the European Regulation (EC) 1907/2006, concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). All intentionally added alloying elements in Ovako products with the exception of nickel are not classified as hazardous. Nevertheless, there are certain substances covered by European and national chemical legislation and lists (REACH Annex XIV and XVII, RoHS-directive (2011/65/EC and 2015/863/EU) Annex II and Global Automotive Declarable Substance List (“GADSL”)) that cannot physically be measured in steel and others that are difficult to measure due to being present in very low levels. The alloying elements in low alloyed steel are firmly bonded in its chemical matrix. Due to this bonding and to the presence of a protective oxide film the release of any of the constituents is very low and negligible when the steel is used appropriately.

### Packaging

**Distribution packaging:** Not applicable.

**Consumer packaging:** Not applicable.

### Recycled material

**Provenience of recycled materials (pre-consumer or post-consumer) in the product:** The hot rolled bar steel product is made from 98% recycled steel and 2% alloying elements.





## Environmental performance

### Potential environmental impact per 1000 kg hot-rolled bar steel product

Parameter	Unit	Upstream	Core	Downstream	Total	
Global warming potential (GWP)	Fossil	kg CO <sub>2</sub> eq.	177	212	INA	389
	Biogenic	kg CO <sub>2</sub> eq.	0	0	INA	0
	Land use and land transformation	kg CO <sub>2</sub> eq.	0	0	INA	0
	Total	kg CO <sub>2</sub> eq.	177	212	INA	389
Acidification potential (AP)	kg SO <sub>2</sub> eq.	1.4	0.44	INA	1.8	
Eutrophication potential (EP)	kg PO <sub>4</sub> <sup>3-</sup> - eq.	0.30	0.082	INA	0.38	
Formation potential of tropospheric ozone (POCP)	kg NMVOC	0.92	0.47	INA	1.4	
Abiotic depletion potential –elements	g Sb eq.	7.4	0.09	INA	7.5	
Abiotic depletion potential – fossil resources	MJ, net calorific value	3980	140	INA	4120	
Water scarcity potential	m <sup>3</sup> eq.	1120	62	INA	1182	

### Use of resources per 1000 kg hot-rolled bar steel product

Parameter	Unit	Upstream	Core	Downstream	Total	
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	552	1400	INA	1952
	Use as raw materials	MJ, net calorific value	0	0	INA	0
	Total	MJ, net calorific value	552	1400	INA	1952
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	4540	4748	INA	9288
	Use as raw materials	MJ, net calorific value	0	0	INA	0
	Total	MJ, net calorific value	4540	4748	INA	9288
Secondary material	kg	997	0	INA	997	
Renewable secondary fuels	MJ, net calorific value	0	0	INA	0	
Non-renewable secondary fuels	MJ, net calorific value	0	0	INA	0	
Net use of fresh water	m <sup>3</sup>	INA	1.35	INA	1.35	

## Waste production per 1000 kg hot-rolled bar steel product

Parameter	Unit	Upstream	Core	Downstream	Total
Hazardous waste disposed	kg	INA	19	INA	19
Non-hazardous waste disposed	kg	INA	182	INA	182
Radioactive waste disposed	kg	INA	0	INA	0

## Output flows per 1000 kg hot-rolled bar steel product

Parameter	Unit	Upstream	Core	Downstream	Total
Components for reuse	kg	INA	0	INA	0
Material for recycling	kg	INA	158	INA	158
Materials for energy recovery	kg	INA	0	INA	0
Exported energy, electricity	MJ	INA	0	INA	0
Exported energy, thermal	MJ	INA	INA	INA	INA

### Influence of alloy content

The results above are presented for an average steel with an average alloy metal content. The influence of the alloy content on the environmental impact of the steels produced in Smedjebacken and Boxholm is shown in the table below. The average (50%) is the same as the declared product; absolute values are presented for the maximum alloy content of 90% of the production and 10% of the production respectively. The values for specific steel products, both value added operations and alloy differences, can easily be provided on request through a "footprint calculator" for the different environmental aspects.

### Variance of environmental impact due to alloy content. Impacts per 1000 kg hot rolled bar steel product

Share of production	kg CO <sub>2</sub> eq	kg SO <sub>2</sub> eq	kg PO <sub>4</sub> -eq	kg NMVOC
90%	432	6,7	0,50	1,9
Average; 50%	389	1,9	0,38	1,4
10%	368	1,2	0,30	1,1

## Additional information

Information on recycling: Steel is 100% recyclable as a raw material for the production of new steel products.



## Programme-related information and verification

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable.

<b>Program</b>	The International EPD® System  EPD International AB Box 210 60 SE-100 31 Stockholm Sweden  <a href="http://www.environdec.com">www.environdec.com</a> <a href="mailto:info@environdec.com">info@environdec.com</a>
EPD registration number	S-P-01136
Published	2017-11-28 Version 2020-10-28
Valid until	2025-10-27
Product Category Rules	PCR 2015:03. BASIC IRON OR STEEL PRODUCTS & SPECIAL STEELS, EXCEPT CONSTRUCTION STEEL PRODUCTS. Version 1.01
Product group classification	UN CPC 412
Reference year for data	2019
Geographical scope	Global

Product category rules (PCR): PCR 2015:03. BASIC IRON OR STEEL PRODUCTS & SPECIAL STEELS, EXCEPT CONSTRUCTION STEEL PRODUCTS. Version 2.0

PCR review was conducted by: The Technical Committee of the International EPD® System.  
Full list of TC members available on [www.environdec.com/TC](http://www.environdec.com/TC)

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

EPD process certification  EPD verification

Third party verifier: Carl-Otto Nevén, NEVÉN Miljökonsult

In case of accredited certification bodies:  
Accredited by: Not applicable

In case of recognized individual verifiers:  
Approved by: The International EPD® System

Procedure for follow-up of data during EPD validity involves third party verifier:  
 Yes  No

## References

General Program Instructions of the International EPD® System. Version 3.0.

PCR 2015:03. Name. PCR 2015:03. BASIC IRON OR STEEL PRODUCTS & SPECIAL STEELS, EXCEPT CONSTRUCTION STEEL PRODUCTS. Version 1.01

Climate impact of Ovako hot rolled bar steel product. Update with 2017 production data. Mats Zackrisson Swerea IVF AB.



Cradle-to-gate. Understanding CO2 footprint of hot-rolled bar steel products. Ovako Group. 2019.

Vattenfall AB Nuclear Power. 2016. Certified Environmental Product Declaration EPD of Electricity from Vattenfall Nordic Nuclear Power Plants. UNCPC Code 17, Group 171 – Electrical energy.

Classen, M., Althaus, H.-J., Blaser, S., Scharnhorst, W., Tuchschnid, M., Jungbluth, N., & Emmenegger, M. (2009). Life Cycle Inventories of Metals Data v2.1 (2009). ecoinvent v2.1 report No. 10.

SimaPro 8.5.0.0. Pré Consultants. 2019.

## Contact information

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Program operator	 EPD International AB, <a href="mailto:info@environdec.com">info@environdec.com</a>



[www.environdec.com](http://www.environdec.com)



# CLIMATE DECLARATION OF HOT-ROLLED BAR STEEL PRODUCT IN SMEDJEBACKEN-BOXHOLM

Functional unit: 1000 kg hot-rolled bar steel product

This climate declaration shows the emissions of greenhouse gases, expressed as CO<sub>2</sub>-equivalents. It is based on verified results from a life cycle assessment in accordance with ISO 14025.

### Information about the product

The declared unit is 1 ton (1000 kg) of hot-rolled bar steel product (round, flat and special profile) at Ovako's gates from our production site in Smedjebacken-Boxholm. With respect to alloying content, the product represents an average product from the sites. With respect to finishing, the products are hot-rolled and ground.

### Information about the company

Ovako is a leading European producer of engineering steel for customers in the bearing, transport and manufacturing industries. Ovako's customers are found mainly in the European engineering industry and its subcontractors. The steel production is based on scrap, making Ovako the largest recycler of steel scrap in the Nordic region. Customers are generally leading manufacturers in their segments. That means they place high demands on the performance of their steel.

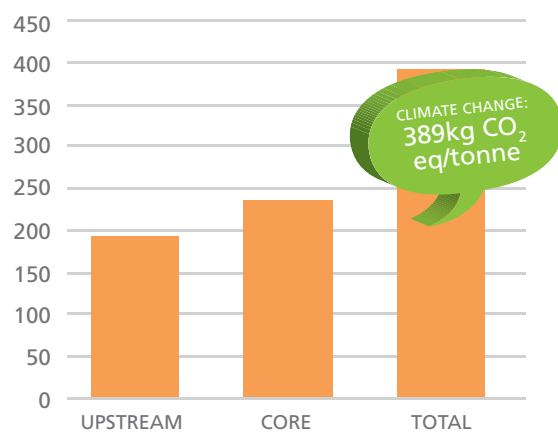
### Climate declaration

The diagram shows the cradle-to-gate climate impact of one ton of hot-rolled bar steel product. All climate impacts from production and transport of raw materials (Upstream) as well as the smelting and rolling operations in Smedjebacken-Boxholm are included (Core). No analysis during use or at end of life is included.

### Other environmental information

The use phase is not included in this declaration. Yet there are many examples where the specific, high-performance properties of Ovako steel offer a positive climate benefit that outweighs significantly the impact of its

KILOGRAM CO<sub>2</sub>EQ PER TONNE  
HOT-ROLLED BAR STEEL PRODUCT



production. These include bearings for wind turbines, increased efficiency for vehicle powertrains and fuel injectors for diesel engines. More information about the environmental impact of Ovako Hot-rolled steel products can be found in an environmental product declaration, available on request.

### Contact

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LINK TO MORE INFORMATION: <a href="http://environdec.com/en/Detail/epd1136">http://environdec.com/en/Detail/epd1136</a>		EPD-PROGRAM: THE INTERNATIONAL EPD® SYSTEM
REGISTRATION NO: S-P-01136	PCR: 2015:03 Version 2.0	PCR REVIEW CONDUCTED BY: TECHNICAL COMMITTEE OF THE EPD® SYSTEM
INDEPENDENT VERIFICATION OF THE DECLARATION AND DATA, ACCORDING TO ISO 14025: EXTERNAL VERIFIER: Carl-Otto Nevén, NEVÉN Miljökonsult		APPROVED BY: THE INTERNATIONAL EPD® SYSTEM
CLIMATE DECLARATIONS FROM DIFFERENT PROGRAMS MAY NOT BE COMPARABLE		
READ MORE ABOUT CLIMATE DECLARATIONS AT <a href="http://www.environdec.com">www.environdec.com</a>		VALIDITY: 2025-10-27

# Project Reference

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Project Name	Product	Building Type	Country	Year	Location	Architect
Soccwe City Stadium	Tension Bars	Stadia	Africa	2010	Johannesburg	Boogerman Urban Edge & Partners in partnership with Populous
Arc by Crown	Post Tensioning & Tension Bars	Other	Australia	2018	Sydney	Koichi Takada
Arise Australia 108	Post Tensioning Bar	Other	Australia	2015	Melbourne	
Australia 108 Tower	Post Tensioning Bar	Other	Australia			
Fairbairn Dam Spillway 500 75	Post Tensioning Bar	Other	Australia			
Norfolk Island	Post Tensioning Bar	Other	Australia			
Stockyard Hill Windfarm	Post Tensioning Bar	Other	Australia			
Sydney Opera House	Post Tensioning	Other	Australia		Sydney	
Queen Victoria Building	Tension Bars	Retail	Australia	2009	Sydney	Anchor Mortlock & Wooley
Bendat Basketball Centre	Tension Bars	Stadia	Australia	2010	Perth	Peter Hunt Architects / Daryl Jackson Architects JV
Melbourne Rectangular Stadium	Tension Bars	Stadia	Australia	2010	Melbourne	Cox Architects and Planners
Ken Rosewall Arena	Tension Bars	Stadium	Australia	2020	Sydney	Arup
Lakhta MFB	Tension Bars	Other	Austria			
Atrio Shopping Centre, Villach	Tension Bars	Retail	Austria	2007	Villach	ATP Architects
Westin & Le Meridien hotel Bahrain City Centre	Post Tensioning Bar	Other	Bahrain			
Gent St Pieters- Rail Station	Post Tensioning Bar	Other	Belgium			
Banff Elementary	Tension Bars	Other	Canada	2019	Alberta	GEC Architecture
CN Tower	Tension Bars	Other	Canada		Ontario	IBI Group
Eventscape	Tension Bars	Other	Canada			
The Shipyards	Tension Bars	Other	Canada			
The Well, Ontario	Tension Bars	Shopping centre	Canada		Ontario	
Toronto Union Station	Tension Bars	Train Station	Canada		Toronto	
Alexander College	Compression Struts	Other	Cyprus			
Asterias Beach Hotel	Galvanised Bracings Balconies	Other	Cyprus		Ayia Napa	D, Michael & Associates
Psevdas Communal Centre	Compression Struts	Other	Cyprus		Psevdas	D Michael & Associates
Bolt Tower	Tension Bars	Other	Czech Republic	2015	Ostrava	
District Archive Brno Building	Tension Bars	Other	Czech Republic	2012	Brno	A Plus a.s. , Brno
Metro Station, Strizko	Tension Bars	Other	Czech Republic		Strizko	
Sky Walk	Galvanised Tension Rods	Other	Czech Republic	2016	Dolni Mavara	Franeek Architects
Strizkov Metro Station	Tension Bars	Other	Czech Republic	2009	Prague	Patrik Kotas, Āi Atelier design a architektury
Campus Square, Brno	Tension Bars	Retail	Czech Republic	2008	Brno	Stir Architects
O2 Dome	Tie Bars	Stadia	Czech Republic		Prague	Vladimir Vokaty / Martin Vokaty2004
Sunwheel "Solhulet"	Stainless Steel Bars	Other	Denmark	2015		
Dong Energy Headquarters	Tension Bars	Other	France			
Dong Energy Headquarters	Compression Struts	Other	France			
Foundation Loui Vitton	Tension Bars	Other	France	2014	Paris	Frank Gehry
La Chrysalide, Arles	Tension Bars	Other	France		Arles	
SYCTOM de l'agglomeration Parisienne, Paris	Tension Bars	Other	France	2011	Paris	
Roland Garros Stadium	Tension Bars	Stadia	France	2020	Paris	Marc Mimram
Frankfurt Exhibition Centre	Tension Bars	Other	Germany	2005	Frankfurt	Hascher Jehle
Messehalle 11, Frankfurt	Tension Bars	Other	Germany		Frankfurt	
TLU for Back to Back Drive Train Test Bench	Post Tensioning Bar	Other	Germany			
Max Aicher Arena	Tie Bars	Stadia	Germany	2010	Inzell	ARGE Behnisch Architekten
Olympiastadion	Tension Rods	Stadia	Germany	2004	Berlin	Gerkan Mars & Partners
Rhein-Neckar Arena	Tension Bars	Stadia	Germany	2009	Sinsheim	Eheim Moebel & Sattler
Stavros Niarchos Foundation Cultural Center	Tension Bars	Other	Greece	2020	Athens	Renzo Piano
One Island East, Hong Kong	Tension Bars	Other	Hong Kong			
Treasure Island	Tension Bars	Theme Park	Hong Kong			
Reykjavik Harbour	Sheet Piling Tie Bars	Other	Iceland		Reykjavik	
Yamuna Sports Complex	Tension Bars	Stadia	India	2010	New Delhi	Peddle Thorp
Indonesian EXPO Centre	Tension Bars	Other	Indonesia	2015		Arups with Cox Architects
Phase 1 MRT	Post Tensioning Bar	Other	Indonesia			
Electrical Masts, Selkirk & Belfast	Holding Down Bar	Electrical Mast	Ireland		Belfast	
IPC House	Tension Bars	Offices	Ireland			
Belfast Harbour Victoria Terminal 4	Sheet Piling Tie Bars	Other	Ireland		Belfast	Hobart Heron
Center Parcs	Tension Bars	Other	Ireland	2019	Longford Fores	
Elm Park, Dublin	Tension Bars	Other	Ireland		Dublin	
Gibson Hotel	Tension Rods	Other	Ireland	2010	Dublin	
The Gibson Hotel, Point Village, Dublin	Tension Bars	Other	Ireland		Dublin	
Victoria Terminal 4, Belfast	Sheet Piling Tie Bars	Other	Ireland		Belfast	
Limerick Greyhound Stadium	Tension Bars	Stadia	Ireland	2010	Limerick	Hamilton Architects
Kuwait University	Tension Bars	Other	Kuwait			
Walverdang Bridge	Tension Bars	Bridge	Luxembourg			
Petronas Tower	Post Tensioning	Bridge	Malaysia	1999	Kula Lumpa	Cesar Pelli
Esplora Science Museum	Tension Bars	Other	Malta	2016	Kalkara	
Casa Bosque Real	Tension Bars	Other	Mexico			
Casaport Railway Station	Tension Bars	Other	Morocco	2014	Casablanca	Arep/Groupe 3A.
Beachcroft Avenue Footbridge, Auckland	Tension Bars	Bridge	New Zealand		Auckland	
Waikato River Bridge	Tension Bars	Bridge	New Zealand	2011	Taupo	
Arts Centre, Christchurch	Post Tensioning Bar	Other	New Zealand		Christchurch	
Auckland Art gallery	Tension Bars	Other	New Zealand		Auckland	
University of Canterbury	Post Tensioning Bar	Other	New Zealand	2016	Christchurch	
SMG Wakaito Stadium	Tension Bars	Stadium	New Zealand			
The Saipan Dragons	Stainless Cables	Other	Northern Mariana Islands	2021	Saipan	DSAA Architects
Kolomoen footbridge	Tension Bars	Bridge	Norway	2009	Hedmark	Moe & Louseeth
Kraksund Bridge- Norway	Post Tensioning Bar	Bridge	Norway			
Steibrug Alvdal	Tension Bars	Bridge	Norway			
Chilet Bridge	Tension Bars	Bridge	Peru			
Cracow Bridge	Tension Bars	Bridge	Poland			

Doprostav Highway	Post Tensioning Bar	Bridge	Poland				
John Paul II Bridge	Tension Bars	Bridge	Poland		Pulawy	POMOST S.C., Warsaw	
KL8 Footbridge	Post Tensioning Bars & Tension Bars	Bridge	Poland		Poznan	Bart=Çomiej Grote	
Krakow Bridge	Tension Bars	Bridge	Poland	2020	Krakow	Bogus=Çaw Pilujski with team (Strabag).	
Warta Arch Bridge	Tension Bars	Bridge	Poland		Gorzow		
Stadion Zaglebia ,Äi Dialog Arena	Tension Bars	Stadia	Poland	2009	Lubin	Bremer A,G,	
Estadio da Luz	Post Tension Bars	Stadia	Portugal	2003	Lisbon	Populous	
Qatar Hamed Airport	Tension Bars	Airport	Qatar				
Al Wahda Arch and Visitor Centre	Post Tensioning Bar	Other	Qatar				
Doha Oasis	Tension Bars	Other	Qatar				
Lusail	Post Tensioning Bar	Other	Qatar				
Qatar National Convention Centre, Sidra Trees	Tension Bars	Other	Qatar		Doha		
SAIF Tip ,Äi Education City, Doha, Qatar	Tension Bars	Other	Qatar		Doha		
Globalworth Plaza, Bucharest	Tension Bars	Offices	Romania	2020	Bucharest	Westforth Architecture	
Skybridge	Post Tensioning Bars & Tension Bars	Bridge	Russian Federation				
Mariinsky Theatre	Tension Bars	Other	Russian Federation	2009	St Petersburg	Diamond Schmitt Architects	
Port Bronka	Sheet Piling Tie Bars	Other	Russian Federation	2015	St Petersburg		
Skolkovo IT Cluster	Tension Bars	Other	Russian Federation	2014	Trekhgorka		
Ust Luga Port	Sheet Piling Tie Bars	Other	Russian Federation	2001	Leningrad Oblast		
Cosmos Arena	Galvanised Tendons	Stadia	Russian Federation	2017	Samara	Kisho Kurokawa Architect & Associates	
Kaliningrad Stadium	Tension Rods	stadia	Russian Federation	2018	Kaliningrad	Jean-Michael Wilmotte	
Mardovia Arena	Tension Bars	Stadia	Russian Federation	2018	Saransk	SaranskGrazhdanProekt	
Rostov Arena	Tension Rods	Stadia	Russian Federation	2018	Rostov-on-Don	Populous	
VTB Arena	Tension Rods	Stadia	Russian Federation	2019	Moscow	Eric Egeraat	
King Abdulaziz Airport	Tension Bars & Compression Struts	Airport	Saudi Arabia				
KACST	Tension Bars	Other	Saudi Arabia				
KAFD 1.14 KAFD 1.15	Tension Bars	Other	Saudi Arabia				
KAFD 2.10 KAFD 5.05 KAFD 5.05	Tension Bars	Other	Saudi Arabia				
KAFD 4.11 KAFD 4.04	Tension Bars	Other	Saudi Arabia				
King Abdulaziz Centre For World Culture ,Äi Children's Oasis ,Äi Dhahran	Tension Bars	Other	Saudi Arabia				
Medical Research Centre	Tension Bars	Other	Saudi Arabia				
Radisson Blu Hotel	Tension Bars	Other	Saudi Arabia				
Riyadh Metro	Tension Bars	Other	Saudi Arabia				
Tadawul Tower, KAFD 1.17 ,Äi Rivadh	Post Tensioning Bar	Other	Saudi Arabia		Rivadh		
Forthside Bridge- Stirling	Post Tensioning Bar	Bridge	Scotland		Stirling		
Queensferry Crossing	Post Tensioning Bar	Bridge	Scotland	2017	Queensferry	Arup with Jacobs Engineering Ltd	
Aberdeen Harbour	Sheet Piling Tie Bars	Other	Scotland		Aberdeen		
Robert Burns Museum	Tension Bars	Other	Scotland	2010	Dumfries	Simpson Brown	
Scottish Parliament, Edinburgh	Tension Bars	Other	Scotland	2004	Edinburgh	Eric Miralles	
Silverburn Centre, Glasgow	Tension Bars	Retail	Scotland	2007	Glasgow		
Edinburgh Zoo Giraffe Viewing Platform	Tension Bars	Zoo	Scotland		Edinburgh		
Wood Square	Tension Bars	Bridge	Singapore	2020			
Mandai Bird Park	Post Tensioning Bar	Other	Singapore				
Marina Bay Sands, Singapore	Tension Bars	Other	Singapore	2010	Marina Bay	Moshe Safdie	
Clark Quay	Tension Bars	Retail	Singapore	2006	Singapore River	ALSOP Architects	
Marina One	Galvanised Carbon Tendons	Retail	Singapore	2018	Marina Bay		
Brodno Vranie	Tension Bars	Bridge	Slovakia		Zilina		
Poprad Bridge, Poprad	Tension Bars	Bridge	Slovakia				
Arena Propad	Tension Bars	Stadia	Slovakia	2006	Poprad		
Regents Park	Tension Bars	Bridge	South Africa	2017	Johannesburg		
Timeball Tower, Durban	Tension Bars	Other	South Africa		Durban		
Mbombela Stadium	Tension Rods	Stadia	South Africa	2010	Mbombella	R&L Architects	
Korean World Trade Centre Foyer	Tension Bars	Other	South Korea				
Korean World Trade Centre Pyramid	Tension Bars	Other	South Korea	2000	Seoul		
Korean World Trade Centre Pyramid	Stainless Steel Cables	Other	South Korea		Seoul		
Malaga Airport	Tension Bars	Airport	Spain		Malaga		
Almonte Bridge	Post Tensioning Bar	Bridge	Spain	2016	Caceres	Arenas & Asociados	
Montabliz Viaduct	Tension Bars	Bridge	Spain				
Navai River Viaduct	Post Tension Bars	Bridge	Spain	2007	Asturias		
Navia River Viaduct, Asturias	Post Tensioning Bar	Bridge	Spain		Asturias		
Pasarela Fuenlabrada, madrid	Tension Bars	Bridge	Spain		Madrid		
Viaducto Marin Ute Arlaban, Guipuzcoa	Tension Bars	Bridge	Spain		Guipuzcoa		
Commercial BriCor, Madrid	Tension Bars	Other	Spain		Madrid		
Munksjo Bridge, Jonkoping	Tension Bars	Bridge	Sweden		Jonkoping		
Sofias Bridge	Tension Bars	Bridge	Sweden	2019	Helsingborg		
University Bridge	Tension Bars	Bridge	Sweden	2004	Malmö	Dissing & Weiting	
Sodra Karra Wind Turbine	Post Tensioning Bar	Other	Sweden				
Wind Turbines Sodra Karra & Blekhem	Post Tensioning Bar	Other	Sweden	2012	Sodra Karra and Blekhem		
Wind Turbines, Uljabuoda	Post Tensioning Bar	Other	Sweden	2012	Uljabuoda		
Geneva Airport	Tension Bars & Compression Struts	Airport	Switzerland		Geneva		
Voldjk Fiesburg Bridge	Tension Bars	Bridge	The Netherlands	2013	Tilburg		
Izmir Airport	Tension Bars	Airport	Turkey		Izmir	YAKUP HAZAN from Ankara	
Osman Gazi	Post Tensioning Bar	Bridge	Turkey	2016	Gulf of Izmit	Dissing & Weiting	
Yavuz Sultan Selim Bridge	Post Tensioning Bar	Bridge	Turkey	2016	Istanbul		
Ronesans Tower	Tension Bars	Other	Turkey	2014	Istanbul	FXCollaborative	
G/ʔsel Aksel Sports and Healthy Life Center	Compression Struts	Stadia	Turkey	2019	Izmir	DB Architects	
Ferrari World Zip Line Abu Dhabi	Cable	Theme Park	UAE		Abu Dhabi		
Abu Dhabi Airport	Tension Bars	Airport	United Arab Emirates		Abu Dhabi		
Dubai International Airport	Tension Bars	Airport	United Arab Emirates		Dubai		
R989 ,Äi Footbridges	Post Tensioning Bar	Bridge	United Arab Emirates				
Sheikh Zayed Bridge, Abu Dhabi	Post Tensioning Bar	Bridge	United Arab Emirates	2010	Abu Dhabi	Zaha Hadid	
Abu Dhabi Financial Centre	Tension Bars	Other	United Arab Emirates		Abu Dhabi		
Abu Dhabi National Exhibition Centre	Stainless Steel Cables	Other	United Arab Emirates		Abu Dhabi		
Burj Al Arab Hotel, Dubai	Post Tensioning Bar	Other	United Arab Emirates	1999	Dubai	Atkins	
Discovery Gardens	Post Tensioning Bar	Other	United Arab Emirates				
Dubai Eye	Tension Bars	Other	United Arab Emirates		Dubai		



Dubai Metro Station	Post Tensioning & Tension Bars	Other	United Arab Emirates	2009	Dubai	
Dubai Metro, Dubai	Tension Bars	Other	United Arab Emirates		Dubai	
EXPO 2020	Tension Bars	Other	United Arab Emirates			
Khalifa University	Tension Bars	Other	United Arab Emirates		Abu Dhabi	
Louvre Abu Dhabi	Tension Bars	Other	United Arab Emirates		Abu Dhabi	
Main Building APM Station	Tension Bars	Other	United Arab Emirates			
One Central	Tension Bars	Other	United Arab Emirates		Dubai	
QAH FORT PALACE AND NCC	Post Tensioning Bar	Other	United Arab Emirates		Abu Dhabi	
Royal Atlantis	Tension Bars	Other	United Arab Emirates			
Zabeel Project	Post Tensioning Bar	Other	United Arab Emirates			
Dubai Hills Mall	Tension Bars	Retail	United Arab Emirates		Dubai	
Dubai Sports City Stadium	Tension Bars	Stadia	United Arab Emirates	2010	Dubai	Godwin Austen Johnson
Sheikh Khalifa Sports City	Tension Bars	Stadia	United Arab Emirates	2013	Bahrain	
Heathrow	Tension Bars	Airport	United Kingdom		London	
A40 Hammersmith Flyover	Post Tensioning Bar	Bridge	United Kingdom		London	
Barnstaple Bridge ,Ai Devon	Post Tensioning Bar	Bridge	United Kingdom			
Beechwood Bridge Overbridge 132	Post Tensioning Bar	Bridge	United Kingdom			
Bletchley Viaduct	S650	Bridge	United Kingdom		Bletchley	
Brayford Wharf	Post Tensioning Bar	Bridge	United Kingdom	2019	Lincoln	Stem Architects
Castleford Bridge, Castleford	Post Tensioning Bar	Bridge	United Kingdom	2008	Castleford	McDowell & Benedetti
Clifton Bridge, Nottingham	Post Tensioning	Bridge	United Kingdom		Nottingham	
Dronfield Rail Bridge	Post Tensioning Bar	Bridge	United Kingdom		Dronfield	
Ely Bypass	Tension Bars	Bridge	United Kingdom		Ely	
Fabian Way Bridge, Swansea	Tension Bars	Bridge	United Kingdom			
Fisher Lane Bridge- Cramlington	Post Tensioning Bar	Bridge	United Kingdom		Cramlington	
Golden Jubilee Bridge, London	Post Tensioning Bar & Tension	Bridge	United Kingdom	2002	London	WSP/Lifschutz Davidson
Hammersmith Flyover Bridge	Post Tension Bars	Bridge	United Kingdom	2012	London	Freyssinet
Hemsworth A1 Link Road	Post Tensioning Bar	Bridge	United Kingdom			
Kilnhurst Bridge- Rotherham	Post Tensioning Bar	Bridge	United Kingdom		Rotherham	
Low Farm Bridge	Post Tensioning Bar	Bridge	United Kingdom			
Mersey Gateway	Post Tension Bars	Bridge	United Kingdom	2017	Cheshire	
Midland Links- Birmingham	Post Tensioning Bar	Bridge	United Kingdom		Birmingham	
Millenium Bridge, London	Tension Bars	Bridge	United Kingdom	2000	London	Foster & Partners
Riverside Bridge, Cambridge	Post Tensioning Bar & Tension Bars	Bridge	United Kingdom	2008	Cambridge	(Public Competition 2004)
St James Viaduct ,Ai Doncaster	Post Tensioning Bar	Bridge	United Kingdom		Doncaster	
The Mersey Gateway	Post Tensioning Bar	Bridge	United Kingdom			
Twin Sails Bridge ,Ai Poole	Post Tensioning Bar	Bridge	United Kingdom	2020	Poole	Wilkinson Ayre
Victoria Road Underbridge- Eaglescliffe	Post Tensioning Bar	Bridge	United Kingdom			
Wainwright Bridge, Blackburn	Tension Bars	Bridge	United Kingdom		Blackburn	
Whitehall Footbridge, Leeds	Tension Bars	Bridge	United Kingdom		Leeds	Carey Jones Architects
Scrabster Harbour	Sheet Piling	Harbour	United Kingdom			
Brunel Building	Tension Bars	Offices	United Kingdom			
Triton Square	Tension Bars	Offices	United Kingdom			
20 Fenchurch Street- London	Post Tensioning Bar	Other	United Kingdom		London	
201 Bishopgate ,Ai Broadgate Tower	Post Tensioning Bar	Other	United Kingdom		London	
22 Bishopsgate	Tension Bars	Other	United Kingdom		London	
51 Lime Street- London EC3	Post Tensioning Bar	Other	United Kingdom		London	
88 Wood Street, London	Compression Struts	Other	United Kingdom	2007	London	Richard Rogers Partnership
A52 Wyvern way	Tension Bars	Other	United Kingdom			
Aaron Klug Building, Cambridge	Tension Bars	Other	United Kingdom		Cambridge	
Advanced Manufacturing Research Centre	Tension Bars	Other	United Kingdom	2015	Rotherham	Bond Bryan Ltd
AMRC Skywalk	Tension Bars	Other	United Kingdom			
Boumemouth Beach Groynes	Tension Bars	Other	United Kingdom		Boumemouth	
Canary Wharf station ,Ai Crossrail	Post Tensioning Bar	Other	United Kingdom		London	
Canary Wharf Tower DS3 - TC7	Post Tensioning Bar	Other	United Kingdom		London	
Canary Wharf Tower TC1	Post Tensioning Bar	Other	United Kingdom		London	
Cutty Sark	Tension Bars	Other	United Kingdom	2007	London	Grimshaw
Devonport Royal Navy Dockyard	Tension Bars	Other	United Kingdom			
Giltspur Street ,Ai London	Post Tensioning Bar	Other	United Kingdom		London	
Grange St. Paul's Hotel, London	Tension Bars	Other	United Kingdom		London	
Hampden Guernsey School, London	Tension Bars	Other	United Kingdom	2003	London	BDP
Highpoint	Tension Bars	Other	United Kingdom	2018	London	
Knottingley Hydro Scheme	Sheet Piling Tie Bars	Other	United Kingdom		Knottingley	
Koko, London	Tension Bars	Other	United Kingdom		London	
Kyleakin Feed Mill Marine Works	Sheet Piling Tie Bars	Other	United Kingdom			
Leadenhall Building, London TC3	Post Tensioning Bar	Other	United Kingdom		London	
Limeburner Lane, London	Post Tensioning Bar	Other	United Kingdom		London	
London Bridge Place ,Ai TC3	Post Tensioning Bar	Other	United Kingdom		London	
London Rd- Newcastle	Post Tensioning Bar	Other	United Kingdom		Newcastle	
London Urban Oasis	Stainless Steel Cables	Other	United Kingdom		London	
Microsoft Main Entrance	Tension Bars	Other	United Kingdom			
Midland Met with additions	Tension Bars	Other	United Kingdom			
Midland Metropolitan Hospital	Tension Bars	Other	United Kingdom			
Newington Butts	Tension Bars	Other	United Kingdom			
One Hyde Park- Knightsbridge	Post Tensioning Bar	Other	United Kingdom		Knightsbridge	
Park House- Oxford St ,Ai W1	Post Tensioning Bar	Other	United Kingdom		London	
Phoenix High School, Shepherds Bush	Tension Bars	Other	United Kingdom		Shepherds Bush	
Queens Quay, Clydebank	Sheet Piling Tie Bars	Other	United Kingdom			
Renault Distribution Centre, Swindon	Tension Bars	Other	United Kingdom	1982	Swindon	Norman Foster/ Foster & Partners
Royal Mint	Tension Bars	Other	United Kingdom			
St Ola Pier	Tie Bars	Other	United Kingdom	2021	Scrabster	
St Paul's Square, Liverpool	Tension Bars & Compression Struts	Other	United Kingdom		Liverpool	
St Pauls Hotel	Tension Bars	Other	United Kingdom			
St Pauls Square	Compression Struts	Other	United Kingdom			
Tees Barrage	Sheet Piling Tie Bars	Other	United Kingdom			
Temple Bar Rebuild, London	Tension Bars	Other	United Kingdom		London	
Temple Waterfron	Sheet Piling Tie Bars	Other	United Kingdom			
Thames Tideways	Post Tensioning Bar	Other	United Kingdom		London	
The Shard , London	Post Tensioning Bar	Other	United Kingdom		London	
Urban Oasis, London	Stainless Steel Cables	Other	United Kingdom	2011	London	Chetwoods
Waterloo Station	Compression Struts	Other	United Kingdom	2020	London	
Wimbledon	Post Tensioning Bar	Other	United Kingdom			

Wood Wharf	Post Tensioning Bar	Other	United Kingdom			
IKEA Greenwich	Tension Bars	Retail	United Kingdom	2019	Greenwich	SRA Architects
Willow Place, Corby	Tension Bars	Retail	United Kingdom	2007	Corby	DLG Architects
Cambridge Science Park	Tension Bars	Science Park	United Kingdom		Cambridge	
Ethiad Stadium	Tension Bars	Stadia	United Kingdom	2002	Manchester	Arups
Tottenham Hotspur Stadium	Post Tensioning	Stadia	United Kingdom	2019	London	Populous
Fulham FC	Tension Bars	Stadium	United Kingdom		Fulham	
Lewisham Exchange	Post Tensioning	Transport	United Kingdom		Lewisham	
Portsmouth University Sports Hall	Tension Bars	University	United Kingdom		Portsmouth	
MIT College	Tension Bars	College	United States of America			
Charlotte Convention Centre	Tension Bars	Convention	United States of America			
Children's Mercy Hospital Kansas City	Tension Bars	Hospital	United States of America		Kansas City	
Academy Museum of Moving Pictures	Tension Bars	Museum	United States of America	2019	Los Angeles	Renzi Piano
1100 15th Street Bridge, Washington, USA	Tension Bars	Other	United States of America		Washington	
51 Louisiana, Washington DC	Tension Bars	Other	United States of America		Washington	
Alexander Court,	Tension Bars	Other	United States of America			
Bentley Heritage Estae Distillery	Tension Bars	Other	United States of America			
Bentley Mill	Tension Bars	Other	United States of America			
Chase Center Arena	Tension Bars	Other	United States of America			
Chicago Arts Museum	Tension Bars	Other	United States of America		Chicago	
Denver Museum	Stainless Steel Cables	Other	United States of America		Denver	
Duke West Campus	Tension BARS	Other	United States of America	2016	Durham	Grimshaw
East Leyden High School	Tension Bars	Other	United States of America			
Emery Station	Tension Bars	Other	United States of America			
Hudson Yards	Tension Bars	Other	United States of America			
Independent Tower, Austin,	Compression Struts	Other	United States of America		Austin	
International Spy Museum	Tension Bars	Other	United States of America	2019	Washington	
Jehovah Witnesses HQ New York	Compression Struts	Other	United States of America		New York	
Milwaukee Streetcar	Tension Bars	Other	United States of America		Milwaukee	
Minnesota University	Compression Struts	Other	United States of America		Minnesota	
Moffet Towers	Tension Bars	Other	United States of America			
Music Lane Building	Tension Bars	Other	United States of America			
Reference: 16-02-1991 Johnson Brothers	Post Tensioning Bar	Other	United States of America			
Santa Fe Medical Centre	Compression Struts	Other	United States of America			
Silicon Labs HQ, Austin, Tex	Tension Bars	Other	United States of America		Austin	
Spy Museum, Washington, USA	Tension Bars	Other	United States of America		Washington	
Stonybrook University, New York	Tension Bars	Other	United States of America			
The Arts Institute of Chicago	Tension Bars	Other	United States of America	2009	Chicago	Renzo Piano
The Independent Tower	Tension Bars	Other	United States of America	2018	Austin Texa	Rhode Architects
Torrance	Tension Bars	Other	United States of America			
Wacker Canopy	Tension Bars	Other	United States of America			
Willis Tower	Tension Bars	Retail	United States of America			
Citrus Bowl	Tension Rods	Stadia	United States of America	2014	Orlando	HNTB
Wrigley Field	Tension Bars	Stadia	United States of America			
Gia Lai Bridge	Post Tensioning Bar	Bridge	Vietnam			



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