BRIDGES
CONCEPT • CASTING • COMPLETION

GOODWIN STEEL CASTINGS
ESTABLISHED 1883
Goodwin Steel Castings Ltd has become synonymous with high standards of precision manufacturing over a history of 130 years.

We are able to supply large machined castings from 50kg to 30,000kg, fabricated castings and assemblies up to 70,000kg from carbon steels, stainless steels, duplex stainless steels and cutting edge materials such as super nickel alloys.

The foundry is supported by its sister company, Goodwin International Ltd, located 8km away, which satisfies our CNC machining, fabrication and assembly requirements.

Goodwin Steel Castings Ltd have supplied cast, fully machined and coated, cable clamps and saddles for some of the world’s longest and most prestigious suspension bridge projects.

Goodwin Steel Castings Ltd and Goodwin International Ltd work in conjunction with each other so, from a single purchase order you can get cast, machined, finished, export packed goods that are made precisely to your drawings and specifications.
Detailed below is an outline of the interaction between a professional design team and Goodwin:

OVERVIEW OF TOWER SADDLE
The initial design was to fabricate the tower saddles out of plate at the top of the bridge columns. Goodwin proposed a casting that could be lifted by the cranes and thus eliminate a lot of high level work whilst also saving money. Using our casting and machining knowledge, working within the clients parameters, we came up with a design, which we sent back to the client for verification, acceptance and subsequent production.

INITIAL DESIGN
Goodwin generate a detailed three-dimensional drawing using the sketch concept and adding features essential to the casting process such as fillets and moulding taper. If required, we can carry out a finite element analysis of the casting to check structural adequacy.

A computer simulation of the solidification of the casting is run to optimise the shape, predict where shrinkage and residual stresses would occur, and then design them out of the component. A drawing is then returned to the client detailing the final dimensioned shape, showing any areas where we would suggest that a deviation be accommodated to achieve cost reduction within our manufacturing process, or to adjust the tolerances as drawn, because they would incur additional costs. We like to clarify everything upfront to ensure that we give you the best price, avoiding any surprises for either party during the project execution.

QUOTATIONS & PROGRAMME
A detailed quotation with a manufacturing, inspection and test plan programme is provided for each enquiry.
PATTERN MANUFACTURE
Our in-house pattern shop produces the patterns from which the castings will be manufactured. The patterns will be used to create the sand moulds into which molten metal is poured.

MELTING & POURING
Metal is melted in one of four electric furnaces and, if required, transferred to the AOD (argon-oxygen decarburisation) vessel for refining. Here, volatile elements are removed from the mix, helping to reduce the impurities and inclusions in the steel.

Molten metal is dispensed from the furnace into a ladle. The ladle is then positioned above the mould before pouring the molten metal into the mould. The metal is then left in the mould to cool until it solidifies. This process can often take days rather than hours. Once cooled, the casting is “knocked out” of the mould and given a preliminary fettling.

TESTING & MACHINING
Following fettling, the casting is heat treated in order to optimise its mechanical properties followed by NDT (non-destructive testing) such as radiographic, magnetic particle or ultrasonic inspection.

The casting is cast with an integral test block that is heat treated with the casting and then destructively tested to prove the heat treatment has given the actual component the correct mechanical properties.

The casting then undergoes machining to the specified dimensions. Here internal cavities or features too complex for the casting process are cut into the component. Any further fabrication will also take place at the machine shop.

Following any testing, final dimensional inspection is conducted before the casting is painted, packed and shipped to its destination.

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The Jiangyin suspension bridge carries a six-lane highway 1,386 metres across the Yangtze River and connects the cities of Jiangyin and Jingjiang.

The bridge is the only fixed crossing of the Yangtze river between Shanghai and Nanjing and is an integral part of the new north-south highway. The bridge was opened on 1st October 1999 to celebrate the 50th Anniversary of the founding of the People’s Republic of China by Chairman Mao.

Goodwin supplied cast, machined cable bands that were finished with a zinc metal spray paint system for superior corrosion resistance.

![A 12 bolt 1800mm cable band assembly undergoing dimensional inspection prior to packing.](image1.png)

Corrosion protection being applied to finished machined cable band.
The Tsing Ma suspension bridge carries both vehicular and railway traffic between the centre of Hong Kong and Chep Lap Kok airport.

Vehicular traffic is carried via two three lane carriageways on top of another twin lane carriageway, next to a twin track railway line.

At 2km long with a 1,377m span and significant road and rail loadings the bridge must also sustain severe wind loadings during typhoon conditions. The bridge was formally opened in 1997.

Goodwin manufactured cable bands with cast rope grooves, so the cable supporting the deck goes over the cable band.
Hardanger Bridge is a 1,380m span suspension bridge that crosses the Hardangerfjord, linking Oslo and Bergen replacing a ferry connection. The height of the supporting towers above sea level is 186m with a maritime clearance of 55m.

Goodwin won the contract to supply cable bands, tower saddles and splay saddles. The tower saddles have been installed at the top of the supporting concrete bridge pylons to carry the massive loads from the supporting deck cables.

The splay saddles that support the main cable are land based and splay it so that the individual parts cable of it are taken to their own anchor points. Each splay saddle is comprised of a machined 13Cr4Ni stainless steel bearing welded to a carbon steel plate box section.

Expert knowledge from Goodwin was required to weld the two dissimilar steels in the splay saddles to prevent distortion of the fabrication and sensitization of the austenitic stainless steel splay saddle, which due to the process route could not be subsequently heat treated.
Oakland Bay Bridge spans the San Francisco Bay carrying traffic on an upper and lower deck. The main section of the western approach is a suspension bridge connecting San Francisco to Yerba Buena Island whilst the eastern approach was, prior to the Loma Prieta earthquake in 1989, a cantilever bridge connecting the island to Oakland.

During the earthquake, a section of the eastern span collapsed onto the lower deck of the eastern bridge.

Reconstruction of the eastern span took the form of a suspension bridge supporting a 10 lane highway with an estimated traffic flow of 270,000 vehicles per day.

Goodwin supplied all of the finished machined cast steel cable bands for the bridge.

Goodwin manufactured 118 carbon steel cable bands in differing sizes (from 2 to 6 tonnes assembled weight) for this bridge.
Many companies promise the world and then fail to deliver on that promise.

At Goodwin we have a simple motto...

“Say what you do; do what you say”

This has built us an enviable and unparalleled reputation in the areas of industry we pursue. With every bridge contract we have ever entered into, we have received letters of commendation for our exceptional high quality standards and on time deliveries.

For the bridges featured in this brochure, our clients feedback can be seen on these pages...
PROJECT     HARDANGER BRIDGE
LOCATION    NORWAY
OPENED      2013
MAIN SPAN   1380 METRES

PROJECT     JIANGYIN BRIDGE
LOCATION    CHINA
OPENED      1997
MAIN SPAN   1386 METRES

Kvaerner Cleveland Bridge

Our ref: 190/D00/S02
30 June 1998

Goodwin Steel Castings Limited
Ray House, Pewsey
Wiltshire
SN19 8RL

For the attention of: Mr Richard Goodwin

Dear Richard,

RE: CABLE BANDS - JIANGYIN BRIDGE, CHINA

I would like to take this opportunity to congratulate you on your recent order for 100 cable bands for your Jangyin Bridge project.

I am pleased to announce that we have completed and delivered all of the cable bands in accordance with your specifications.

The quality of the bands was excellent, and we are confident that they will meet the high standards required for this project.

I would like to express my gratitude to you and your team for your cooperation throughout this project. We look forward to working with you again in the future.

Yours sincerely,

[Signature]

Peter Robinson
UK PROJECT MANAGER

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CASTING FACILITIES

FOUNDRY CAPABILITY

• Finite Element analysis solidification simulation

• Melting by electric arc and induction furnaces – refining by AOD (argon-oxygen decarburisation) vessel

• Non-destructive testing by ultrasonic, magnetic particle, dye penetrant, radiography by 9MeV linear accelerator. In-house ASNT level III

• Gas fired heat treatment with a capacity of 50 tonnes to a temperature of 1,300°C. Furnace, air, forced air and water quenching cooling

• In-house pattern shop

• Fully qualified welders

• Test house for mechanical, corrosion and chemical analysis

• 24 / 7 Shift working at the foundry
DELIVERING EXCELLENCE EVERY TIME

NDT (NON-DESTRUCTIVE TESTING)
Goodwin carry out extensive in-house NDT testing including; radiographic, ultrasonic, dye penetration and magnetic particle inspection techniques.

SURFACE FINISH OR ROUGHNESS
All Goodwin castings for the construction sector meet the requirements of BS EN 1370, Surface Roughness Inspection by Visual Tactile Comparators.

REFERENCES
Castings in Construction, SCI P172
BS EN 10340 Steel Castings for Structural Uses
BS EN 1559 Parts 1 and 2 Founding - Technical Conditions of Delivery
BS EN 10002 Tensile Testing
BS EN 10045 Charpy Impact Test
BS EN 10204 Inspection Documents
BS EN 1369 Magnetic Particle Inspection
BS EN 1370 Visual Surface Comparators
BS EN 1371 Liquid Penetrant Inspection
BS EN 12680 Ultrasonic Inspection
BS EN 12681 Radiographic Inspection

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MECHANICAL ENGINEERING CAPABILITY

- Fully equipped CNC machine shop
- 100 tonne in-house overhead cranes
- Dedicated technical welding bay
- Full offline CNC programming and verification
- Large climate controlled CMM (5m x 3m x 2m)
- Laser measuring on-site
- Climate controlled gauge room
- 24/7 shift working at the machine shop

MACHINING FACILITIES

Milling up to 4m in ‘Y’
8m in ‘X’
50 tonne

3m x 3m band saw
50 tonne

Turning up to 5.4mØ
30 tonne

BRIDGES
CONCEPT • CASTING • COMPLETION
Complex geometry fabrication of castings and subsequent machining

Positional fabrication welding

Fabricated, pressure tested, built up assemblies.
All done in-house at Goodwin International

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Goodwin Steel Castings is part of the Goodwin Engineering Group and one of the foremost, independent producers of high alloy and high quality integrity castings in Europe.

**APPROVALS & CERTIFICATES**

**ACCREDITED MANAGEMENT SYSTEMS**
- Quality (ISO9001)
- Environmental (ISO14001)
- Health and Safety (OHAS 18001)

**MANUFACTURING APPROVALS**
- Lloyds Register (LR)
- American Bureau of Shipping (ABS)
- Det Norske Veritas (DNV)
- NORSOK
- Rolls Royce

**BSEN10340 : 2007 / AC : 2008**
Goodwin is an approved manufacturer of steel castings for the construction industry

- Queens Award for Enterprise
- RIBA Approved CPD Provider
- The Welding Institute
- British Constructional Steelwork Association
- Steel Construction Institute
- Casting Metals Federation

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Goodwin are able to supply CE marked castings to BSEN10340
CONTACTS & LOCATION

Goodwin Steel Castings is easily accessible from the M6 motorway at junction 15 or 16 and then along the A500. From the M1 motorway, take junction 24a and then the A50 to Stoke-on-Trent.

Brian Quinn
Sales Director
Tel  +44 (0)1782 220244
Mobile +44 (0)7766 315829
Email bquinn@goodwingroup.com

Peter Stokoe
Construction Sector Sales Manager
Tel  +44 (0)1782 220338
Mobile +44 (0)7854 474470
Email pstokoe@goodwingroup.com

Goodwin Steel Castings Ltd
Ivy House Foundry
Stoke-on-Trent
ST1 3NR
United Kingdom

Tel  +44 (0)1782 220000
Fax  +44 (0)1782 208060
Email castings@goodwingroup.com
Web  www.goodwinsteelcastings.com

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