

Goodwin International is a world leader in the supply of large precision machined high integrity components including pressure vessels, gas turbine parts and power station valves amongst other applications.

We are also an accomplished supplier to the suspension bridge sector. With our sister company Goodwin Steel Castings we produce a variety of components including the supply of castings, fabrication, machining and sub assembly in a wide range of materials from carbon steels to the more exotic stainless and duplex stainless grades.

Recent supply includes the Hardanger Bridge in Norway, a 1,380m-long suspension bridge opened in August 2013. It crosses the Hardangerfjord in Norway and replaced the ferry connection between Brurvik and Brimnes on the highway 7/13. Goodwin International Limited and its sister company Goodwin Steel Castings Limited supplied in excess of 330,000kg of finished machined components including GX3CrNi13/4 cable bands, tower saddles and splay saddles. Two of the components, the tower saddle and splay saddle were particularly problematic for the project.

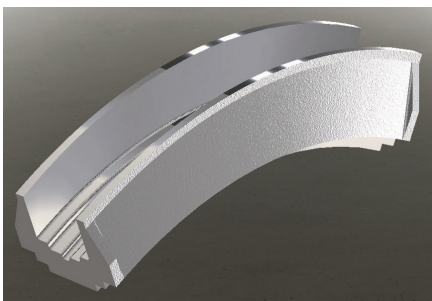
## Tower Saddles

Tower saddles are installed at the top of the supporting concrete pylons to carry the massive loads from the supporting deck cables.

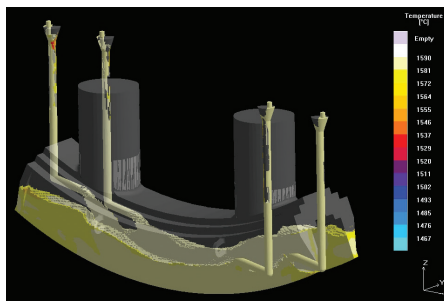
The initial design was to fabricate the tower saddles out of plate at the top of the bridge columns, which are 186m above sea level. Goodwin proposed a fully machined cast alternative that could be lifted by crane and thus increasing safety by eliminating extensive work required at extreme height and also reduced costs by eradicating the need for specialised welding.



Due to the complex geometry and stringent tolerances required to machine the tower saddles many other possible suppliers would have great difficulty in machining, however Goodwin have a number of large 5-axis machining centres, giving us the ability to machine complex shapes in a single set-up. Thus reducing machine set-up time and increasing production rates. Each fully machine tower saddle weighed 13,500kg and were just over 4 metres in length.



Three Dimensional design stage drawing.



Computer solidification simulation.



Finished machined splay saddles.

## Splay Saddles

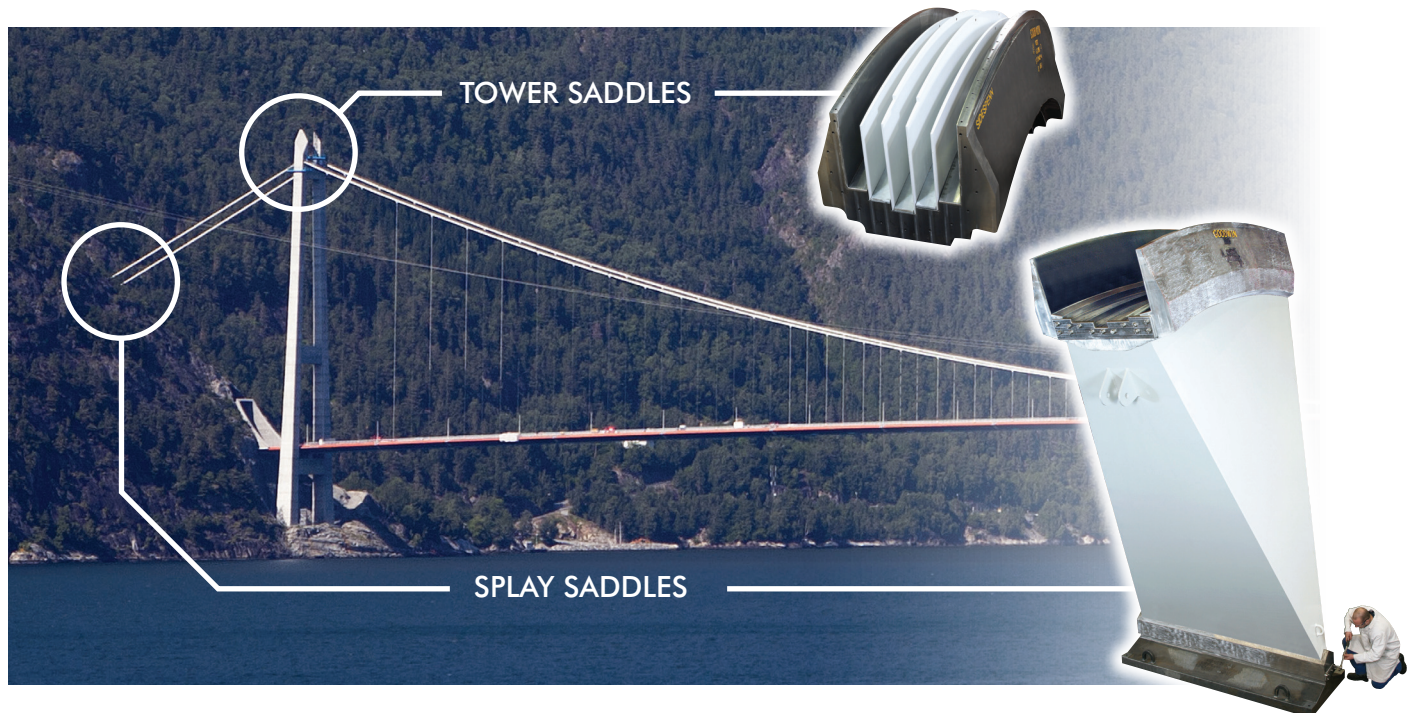
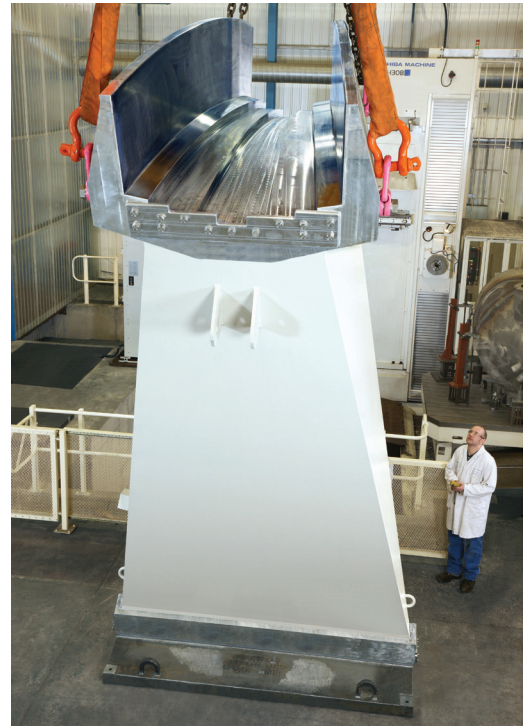
Splay saddles support the main cable and are land based, their function is to spread the main cable into individual cable strands which are then taken to their own anchor points.

The GX3CrNi13/4 cast splay saddles are welded to the carbon steel fabrication.

Expert knowledge from Goodwin was required as to weld the two dissimilar steels in the splay saddles to prevent distortion of the fabrication and sensitisation of the austenitic stainless splay saddle, which due to the process route could not be subsequently heat treated.

The welded joint incorporates a welded nickel alloy 625 intermediate layer, which Goodwin developed with The Welding Institute (TWI). Thus allowing the fabrication to be welded to the splay saddle without the need for a post weld heat treatment.

When fully assembled the splay saddles weigh 26,500kg.



Goodwin engineers have many years experience dealing directly with engineers talking their language and tailoring their needs with our ability to add manufacturability to designs, manufacture finished components as well as procure ancillary components to meet the project requirements.

Success in supplying large companies and projects arises from the tight integration and communication between the foundry and machine shop, offering our customers a single integrated solution.

Our facilities are retained under common management by the sixth generation of the Goodwin family who have supplied cast product for over 130 years.



## Company Objective / Strategy


The Company's main objective is to have a sustainable long term engineering based business with good potential for growth while providing a fair return to our shareholders, and excellent value for our customers.

The Company's strategy to achieve this is:

- To supply a range of technically advanced products to growth markets in mechanical engineering in which we have built up a global reputation for engineering excellence, quality, efficiency, reliability, price and delivery;
- To manufacture advanced technical products safely, profitably, efficiently and economically;
- To main an ongoing programme of investment in plant, facilities, health and safety, sales and marketing, research and development which sets us apart from the mainstream of engineering product suppliers by enabling us to provide larger products with better assured quality and consistency whilst also allowing us to increase efficiency, reduce costs, and in crease overall performance, thus enabling us to deliver better products for our customers, expand our global customer base and keep us at the forefront of technology within our markets;

Allied to this strategy is the need:

- To control our working capital and investment programme to ensure a safe level of gearing as directed by the Parent Company;
- To maintain an adequate capital base to retain investor, customer, creditor and market confidence and so help sustain future development of the business;
- To support a local presence and local workforce;
- To invest in training and development of skills for the Company's future.

  
**Statens vegvesen**

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Att: Richard Goodwin

Behandlende enhet: Region vest	Saksbehandler/firma/gsmr: Asbjørn Valen - <tomt>	Vår referanse: 2010/011263-036	Deres referanse:	Vår dato: 29.08.2012
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**Rv7/rv13 Hardangerbrua, BRU-05 Saddles and Cable band  
Letter of recommendation**

On request we hereby give Goodwin International Ltd. the reference in respect of their supply performance on cable bands and saddles to the Hardanger bridge.

For the project Hardanger Bridge, a suspension bridge with 1310 m main span, Goodwin International Ltd., in contract with The Norwegian Public Roads Administration has delivered all the cable bands and saddles for this project.

The scope of delivery:

4 Pylon saddles made of cast steel grade GX3CrNi13-4+QT – EN 10213:2007. The bottom curved saddle groove is precision CNC machined. Total weight 50 tonne.

4 Splay saddles made of cast steel grade GX3CrNi13-4+QT – EN 10213:2007. Saddles welded to a box made of carbon steel S355N – EN 10025-3. The bottom of the saddle box welded to a bearing of cast steel grade GX3CrNi13-4+QT – EN 10213:2007. The saddle groove is machined. Both the bottom and the walls of the saddle groove are curved. Total weight of splay saddles included saddle box, bearings and separator plates is 109 tonne. Saddle boxes are metallized and painted.


44 cable clamps (cable bands) made of cast steel grade G20Mn5+QT – EN 10213:2007. Cable clamps are fully machined. Total weight 16 tonne. Cable clamps are metallized and painted.


130 hanger clamps (cable bands) made of cast steel grade G20Mn5+QT – EN 10213:2007. Cable clamps are fully machined. Total weight 155 tonne. Hanger clamps are metallized and painted.

10 machined forged steel hangers of steel grade ASTM A182 F6NM. Total weight 7 tonne. Hangers are painted.

The contract to supply has been accomplished according to the specified quality. The supply has been full filled in excellent co-operation. The technical quality of the products are excellent. All the milestones for delivery on site were met.

The Norwegian Public Road Administration can give Goodwin International Ltd. the best recommendations for their supply performance on specify scope of delivery to the Hardanger bridge project.

Best Regards  
  
Øivind L. Sovik  
Projectmanager

  
Asbjørn Valen

Commendation letter for the work completed by  
Goodwin International for the Hardanger Bridge Project.