

# New Application Awards 2021





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## Introduction

For the 6th time, ISSF members have participated in the ISSF New Application Awards. For the New Technology Awards we are looking to recognise original concepts that make significant contributions in either the production methods for stainless steels or for the application of stainless steels in service.

In the New Development category we are looking for highly original concepts that promote bespoke stainless grades, have a significant global market potential and offer strong environmental improvements in terms of preservation of scarce resources and/or reduction of GHGs and/or reduction in lifetime maintenance costs.

In each Awards category three winners are chosen, giving them a Gold, Silver or Bronze Award. The ISSF Team strongly believes all case studies and all the work done at the member sites help companies to innovate and find novel applications and technology for their products.

All companies supplying case studies for the application awards had to answer the following questions:

## The Challenge

What issues were you trying to address or what feature were you trying to develop?

## Why?

Why did you decide it was necessary to address this challenge?

## Needed Action

What action(s) did you take to address the issue or undertake the development?

## Action Review

Were the action(s) taken SMART? Specific, Measurable, Achievable, Realistic and Time-bound? Please describe.

## Horizontal Expansion Capability

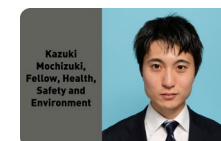
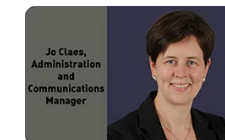
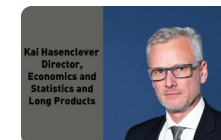
Can the actions or approach taken be expanded for use elsewhere to develop other new applications? (Please explain)

## Outcome

What benefits have you observed and quantified since you took the action? Please also explain the value of each of the stated benefits to business efficiency, cost, material quality, inventory levels and sales (KPIs).

We hope the case studies will give inspiration to other member companies worldwide.

## The ISSF Team



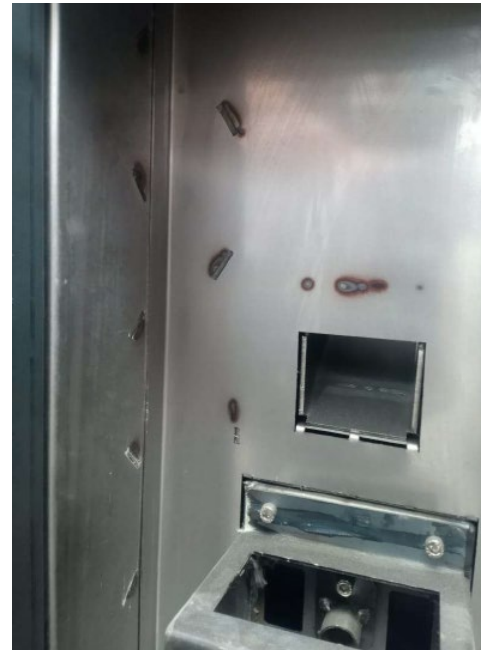


## 3CR12 in Stove Baffle

**Member company** Acerinox  
**Category** original concept for production of or application of stainless steels

### The Challenge

Rapid oxidation and destruction of the heater baffle.



### Why?

Because the market has minimum duration standards for a part like this (2 years).

### Needed Action

Materials research, laboratory tests and technical advice from Acerinox.

### Horizontal Expansion Capability

Of course, in fact they are already being used in the manufacture of pellet heaters ... and in other business areas of the company (laser cutting services and products on demand).

Pictures courtesy of INGENIERIA DE COMBUSTION BOSCA CHILE S.A



## Outcome

Post-sale claims have been reduced by 90%. In our case, the savings in guarantees generated is insignificant with respect to maintaining the reputation of the brand (Bosca).



Pictures courtesy of INGENIERIA DE COMBUSTION BOSCA CHILE S.A



## Balcony Connectors

Member company	Acerinox
Categories	reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials

### The Challenge

Supply Halfen Polska with materials that would improve life cycle and durability of their products.

### Why?

The construction sector requires solutions that are simple, durable and reliable. Stainless steel is a perfect material for such requirements and applications. Thanks to high mechanical characteristics, corrosion resistance and simplicity of usage - 1.4362 bars are perfect for this application.

### Needed Action

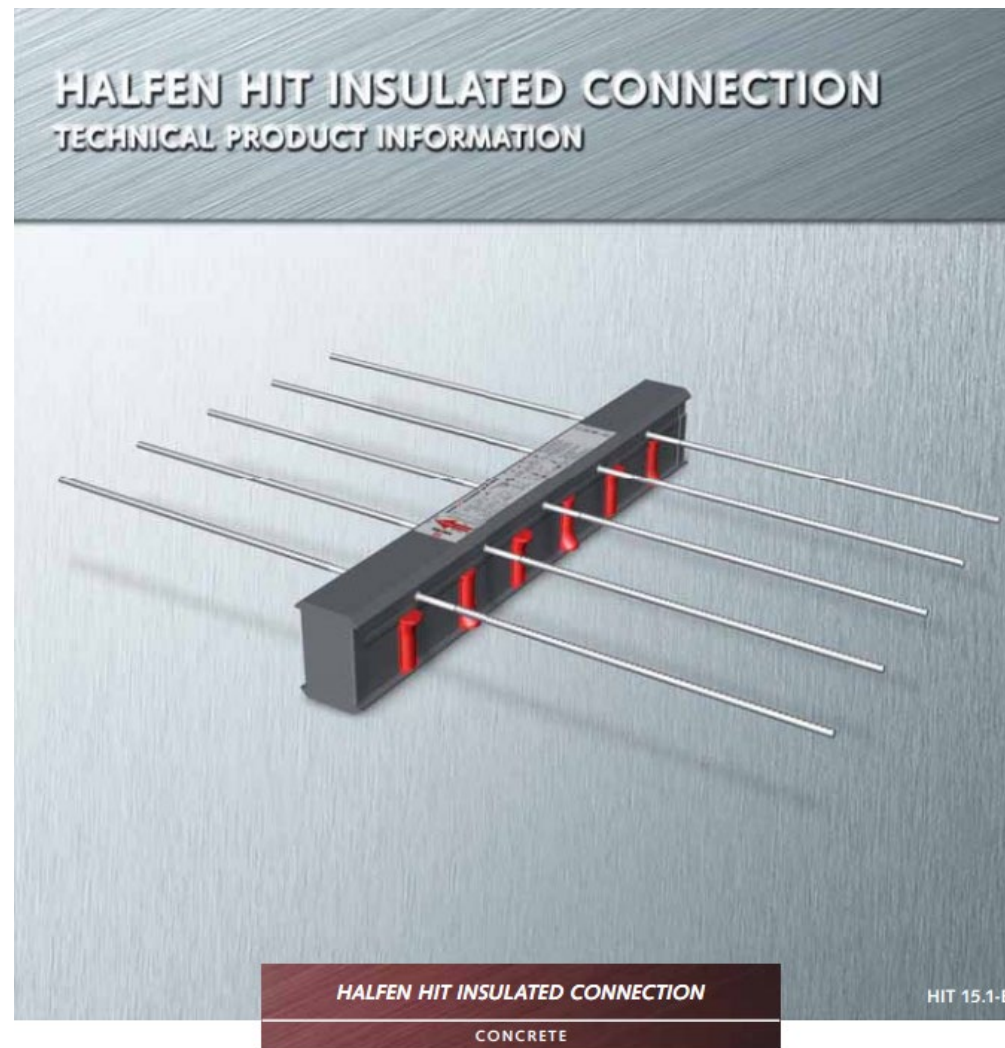
Already in use.

### Action Review

**Specific:** balcony connectors

**Measurable;** it give measurable costs saving in long term maintaining costs.

**Achievable;** product is already in use and becomes more popular with time

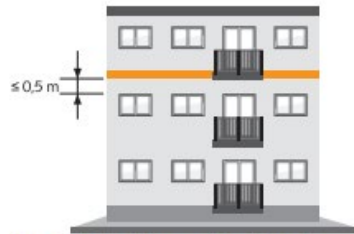


Source: [Halfen](#)

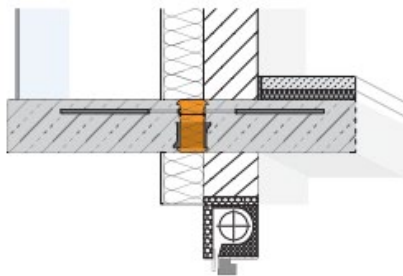
# Be on the safe side.

We take fire protection seriously.

The fully enclosed HIT-HP and HIT-SP ensure compliance with the highest fire safety requirements in accordance with REI 120 according to EN 13501 as well as classification F120-AB according to DIN 4102 in compliance with ETA-13/0546 and numerous other approvals. This is made possible by the special shape of the insulation in combination with the use of high-quality non-flammable mineral wool, Building Material Class A1 and Euro Class A1, respectively.



Circumferential fire barrier as an efficient fire barrier in the insulation layer with full balcony integration



Installation detail: HIT-HP and HIT-SP units as part of fire barrier



Additional fire protection measures, e.g. circumferential fire barrier or additional lintel fire protection, must be provided to increase the resistance of external thermal insulation composite system using expanded polystyrene (EPS).



The HIT-HP and HIT-SP units work as a fire barrier around the area of balconies and porches and ensure the necessary fire-retardancy of ETIC-Systems.

This reduces additional costs for fire prevention.



**Realistic;** Already developed and in use

**Time-bound;** Being used

## Horizontal Expansion Capability

Application of stainless steel in more construction produced of concrete.

## Outcome

Thanks to the combination of few important features of stainless steel and 1.4362 duplex grade – high corrosion resistance, high mechanical values balcony connectors become more durable, easy to produce, reduce costs of maintenance, and guarantee proper mechanical characteristics of final product.



## Fines Collection Systems

**Member company**  
**Categories**

**Aperam**  
original concept for production of or application of stainless steels; degree of contribution; significant global market potential or reduction in operational costs; strong environmental improvement potential; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials

### The Challenge

Cyclones, which are fines collection systems, play an indispensable role in keeping emissions under the regulated limits during several stages of an industrial process. However, in the agribusiness industry, the high moisture levels inside a cyclone's ducts causes significant corrosion. When corrosion takes these cyclones out of commission to undergo expensive maintenance, there is an increased risk for an environmental incident.

The typical cyclone system, which is made of carbon steel, requires critical maintenance annually. By replacing the use of carbon steel with stainless, this project aims to achieve at least a five time increase in the cyclone's lifespan. This improvement would fit the customer's budget requirements and would be positioned as a competitive alternative to carbon steel solutions.



Pictures courtesy of Aperam

### Why?

Emissions have a negative impact on the environment and effect the communities around industrial facilities – both of which go against Aperam's commitment to sustainability. Furthermore, the frequent maintenance interventions were harmful to our customer's processes and dangerous to their associates. Leveraging our strong background in corrosion, Aperam was well-positioned to study the application and propose a better solution.





## Needed Action

The first step was to understand how corrosive the moisture was and, based on this, list some suitable stainless steel alternatives. We conducted a bottom-up analysis of the ducts and vessels and mapped the critical regions. Next, we decided to replace the carbon steel with stainless steel. The prototype was operational in late 2015, with measurements and inspections starting immediately thereafter.

## Action Review

**Specific:** Both Aperam and our customer's engineering teams set a goal of achieving a five times improvement in equipment lifespan with ZERO issues related to corrosion at critical points and with no leakages or unplanned maintenance.

**Achievable:** The customer proceeded with regular inspections on the full system. Aperam also conducted its own quarterly technical inspections, always looking for potential system weaknesses.

**Realistic:** To maintain the best cost-benefit ratio, we established an incremental goal of achieving a fivefold increase in lifespan. Complaints regarding corrosion or wall thickness losses were key indicators.

**Time-bound:** The equipment was installed in 2015, with measurements taken until 2020. Results were aligned with the initial milestone.



Pictures courtesy of Aperam



## Horizontal Expansion Capability

Yes, it is possible to apply knowledge to a system with similar humidity and similarly performing fine particles. Some types of equipment, such as bran coolers, were rebuilt using the same stainless steel and achieved the same results. Other parts of industrial boiler systems are already using the same technology.

## Outcome

Increased equipment life and a reduction in maintenance and other labour expenses  
Reduction in equipment weight: mechanical properties and high corrosion resistance of stainless steels means no overweight or painting costs  
No leakages and no environmental issues  
The customer was able to reduce its spare carbon steel plate inventory because no maintenance was required  
For Aperam, this segment represents a 1k ton market in the short term, with several side applications that could boost this number in the coming years.



## Redlers

**Member company**  
**Categories**

**Aperam**  
original concept for production of or application of stainless steels; degree of contribution; significant global market potential or reduction in operational costs; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials

## The Challenge

Equipment used to transport grain, such as soybean processors, are subjected to a significant amount of wear and tear. Because these machines are often made of inefficient materials, they regularly breakdown and require high maintenance costs – all of which create a real bottleneck for the grain crushing and oil extraction industries.

By developing an economically feasible, technically suitable stainless steel grain transporter, we have successfully eliminated the thickness loss that has plagued the walls of this type of equipment.



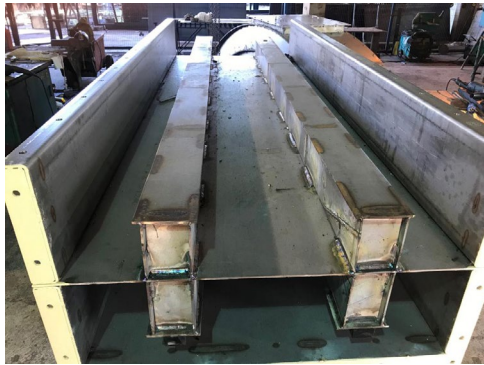
Pictures courtesy of Aperam

## Why?

Maintenance teams charged with the upkeep of these grain transporting equipment regularly complained about the high costs of the raw material (typically carbon steel and coatings), the complexity of assembling devices in remote locations, safety issues, and the negative impact these issues had on yield and quality.

## Needed Action

We started by investigating the equipment's wear mechanism and environmental corrosivity. After collecting several field samples, we were able to understand the corrosion cycle and, from there, develop a stainless steel specification that took into account both corrosion resistance and mechanical properties. Based on this, in 2018, we produced a Redler for a key partner and have been measuring thickness loss and other issues since. The results are impressive.



Pictures courtesy of Aperam

## Action Review

**Specific:** Reduce wear and corrosion in critical devices. By involving the development teams from both Aperam and the customer, we were able to find a financially feasible, technically sustainable solution.

**Measurable:** We aimed to match, as close as possible, the original equipment's assembly budget. Wall thickness was measured annually, with routine corrosion inspections scheduled throughout.

**Achievable:** To achieve our goals, Aperam and the customer committed to allocating all the necessary resources, including teams specifically trained to identify abnormalities. This commitment and partnership were paramount to our success.

**Realistic:** Our initial goal was to achieve a threefold increase in the machine's lifespan, which, based on our previous analysis, was a realistic goal.

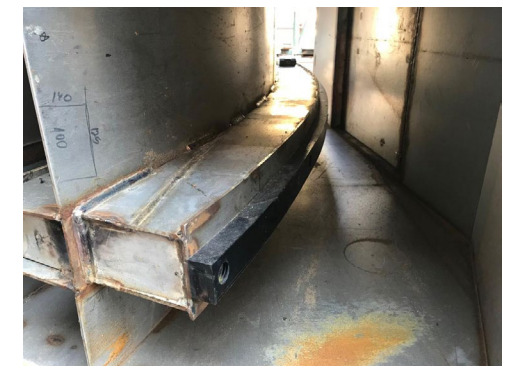
**Time-bound:** Because the original Redler required annual maintenance, we agreed to a minimum testing period of three years. The prototype was launched in January 2018, with regular measurements happening through January 2021.

## Horizontal Expansion Capability

The same knowledge and approach has been applied to other types of transporting equipment/parts with similar characteristics, including chutes, helicoidal transporters, tubes, etc.

## Outcome

The project not only succeeded, it exceeded our original expectations. After three years of continuous, routine use, the results confirm zero signs of wear or significant indicators of corrosion. Corrective maintenance costs due to wear and corrosion were also eliminated, thus increasing the equipment's operational availability. Furthermore, no leakages were observed, which has a positive impact on production yield and product quality.



Pictures courtesy of Aperam



Australian Stainless Steel  
Development Assoc.

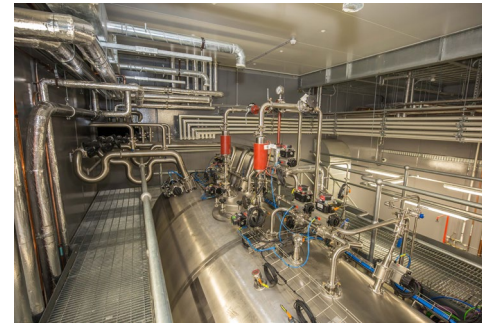
## Post Entry Quarantine (PEQ) Facility

**Member company**  
**Categories**

**ASSDA**  
original concept for production of  
or application of stainless steels;  
strong environmental improvement  
potential; preservation of scarce  
resources; reduction in routine  
maintenance costs

### The Challenge

Safeguarding Australia's environmental biosecurity is critical is preventing the introduction and spread of pests and diseases, and the Post Entry Quarantine (PEQ) facility in northern Melbourne sets the benchmark in international best practice with the use of stainless steel. The state-of-the-art, purpose-built operation was constructed to streamline Australia's quarantine services and consolidate five pre-existing Commonwealth PEQ facilities spread across the country. The 144ha site includes an administration building, modern laboratories, dog and cat receiving area, horse facilities and separate compounds for birds, ruminants, bees, plants, horse veterinarians, dogs and cats. Today, as Australia's flagship quarantine control centre, the integrated PEQ facility is the first point of entry for all imported animals, plant material and insects entering the country, providing secure accommodation and biological containment.



Pictures courtesy of Geschke Plumbing

### Why?

One of the more challenging aspects of the PEQ facility's construction was the design and build of the avian compound. The complex and demanding brief included the delivery of five high-criticality biocontainment units under Quarantine Containment Level 3 (QC3) requirements, the highest level of biosecurity containment. Containment of micro-organisms and prevention of the release is of utmost importance, and mitigating and eliminating risk of exotic pathogens and disease connected to avian imports such as fertile eggs and live birds is critical.

### Needed Action

In association with UK-based Suncombe Engineering, ASSDA Member Fineweld Stainless Steel was engaged by the project's hydraulics contractor, Geschke Plumbing, to supply, manufacture, and install the wastewater decontamination plant system and connecting containment pipework for the treatment of QC3 biowaste products in the avian compound. The wastewater decontamination plant system required a 12,500L collection vessel and 1,750 heat treatment

vessels. The collection vessel was fabricated from 316 grade stainless steel and the treatment vessel from 2205 duplex stainless steel with a 2B 0.6um finish at Fineweld Stainless Steel's Melbourne workshop. Following manufacture, the treatment vessel was packaged and transported to Suncombe Engineering in the UK for final assembly into the wastewater decontamination plant and to undergo a complete Factory Acceptance Test (FAT) as a certified testing authority. The wastewater decontamination plant was then transported back to Fineweld Stainless Steel in Australia for pre-testing at their facility and then installation on site. In addition to the two vessels, Fineweld Stainless Steel installed and welded the connecting pipework on site, manufactured from 5t of 316 grade stainless steel. All pipework welded joints – approximately 1,500 butt welds – were orbital welded and each one inspected, tested and recorded as part of the project scope to comply with the client's strict QC3 requirements.

## Action Review

**Specific;** To supply, manufacture, and install the wastewater decontamination plant system and connecting containment pipework for the treatment of QC3 biowaste products in the avian compound of the new integrated PEQ facility.

**Measurable;** Excellent project management. In addition, the equipment produced underwent critical testing at various stages prior to final assembly and installation on site to ensure long-term asset performance.



Pictures courtesy of Geschke Plumbing

**Achievable;** Suncombe Engineering is a worldwide leader in the field of wastewater decontamination and Fineweld Stainless Steel is the sole appointed agent for the Australian market, with a local manufacturing facility to manage and deliver the required brief.

**Realistic;** All contractors involved had the technical and manufacturing capability to deliver the project, and collaboration was key in producing the successful end result.

**Time-bound;** Extensive logistical challenges were diligently managed, and in collaboration with Suncombe Engineering (UK) and Geschke Plumbing, the project was delivered on time and on budget by the Fineweld Stainless Steel team.

## Horizontal Expansion Capability

This is a unique and niche application that showcases stainless steel's strength, hygiene properties, corrosion resistance and overall performance. It is an excellent example of the importance of using stainless steel material for longevity and performance requirements where decontamination, sterilisation and preventing the transmission of environmental pathogens and other diseases is concerned. Collating and promoting niche applications such as this hero example will create conversation and provide pathways for potential new stainless steel applications in critical processes. It also promotes the knowledge, skill and



Picture courtesy of Fineweld Stainless Steel



Picture courtesy of Fineweld Stainless Steel

welding techniques behind the use of our material and industry.

## Outcome

QC3 facilities use gaseous decontaminants including vaporised hydrogen peroxide and chlorine dioxide. The use of stainless steel offers material strength, hygiene and resistance to both corrosion and the chemicals required to deactivate pathogens, whilst ensuring a gas-tight system for fumigable ductwork.

In what would have been traditionally manufactured and imported from overseas suppliers, ASSDA Member Fineweld Stainless Steel is showcasing the high quality and technical capability of Australian stainless steel manufacturing, producing high-end pressure vessels and complex works for a demanding and precise application. World-class infrastructure demands high quality products and long-term asset performance, both of which have been successfully delivered for the avian compound of the new PEQ Facility through superior local workmanship and the use of stainless steel.



## Efficient Sanitation System to Combat the Global (Rural) Sanitation Crisis

### Member company Categories

**Columbus Stainless**  
original concept for production of or application of stainless steels; strong environmental improvement potential; preservation of scarce resources; life-cycle costs lowest compared to competing materials

### The Challenge

The global sanitation crisis is addressing the need for an ecologically sound and hygienic solution.

Adequate, hygienic sanitation systems are not equally available for the developing and rural parts of South Africa. This is exaggerated by the scarcity of access to running waters in these regions.

### Why?

Developed urban areas use traditional water closet toilet systems. In rural or remote areas that do not have sufficient access to potable or running water, pit latrine sanitation systems remain the dominant alternative. There are dangers associated with the pit latrine systems. These include:

- Groundwater and river pollution if the system is not designed to treat the by-products correctly.
- Poor disposal systems of liquid faecal sludge results in hygienic concerns due to build-up of hazardous waste and harmful bacteria.

- The pit system does not operate on a permanent basis, so when the existing units are full they are covered with soil, requiring new units to be erected. Available space becomes a constraint.

Betram's Amalooloo product range addresses these underlying issues, supplying a safe, dignified and hygienic sanitation system.

### Needed Action

Betram Pty (Ltd) has developed and patented a unique sanitation system for both Waterborne and Dry (Ventilated Improved Pit) structures, called the Amalooloo. The Amalooloo is an affordable, sustainable system, offering a holistic sanitation loop which includes the safe management, collection, storage, treatment and disposal of human waste. The Amalooloo sanitation systems do not require running water systems in order to function and is only dependant on natural environmental conditions.

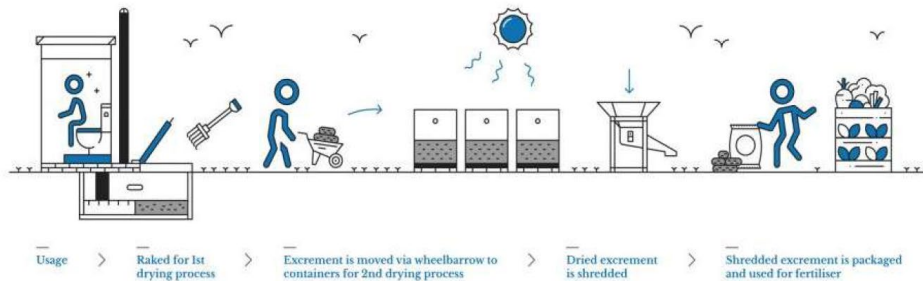
#### How the system works:

Amalooloo sanitation technology makes use of a complete dry composting system, by preventing the creation of faecal sludge – one of the leading causes of sanitation related diseases and deaths. The liquid waste, comprising of the hand washing water and urine, is separated from the solid organic waste by means of a separator and diverted into the soil via an irrigation outlet. The resultant nutrient rich soil becomes the ideal location to plant a vegetable garden for the community.

The solid organic waste material collects in a specialised bottom substructure, where it undergoes primary and secondary drying processes. These drying processes are unique to Amalooloo's state of the art ventilation system, which ensures a fresh supply of air enhancing the drying process whilst guaranteeing an odour and fly free sanitation system. This is facilitated by UV resistant



ventilation outlets (located in the exterior of the units) which are heated by the sun, creating a vacuum within the ventilation system. This vacuum causes the warm stale air to move up and out of the substructure, replacing it with cooler fresh air. Once the solid organic waste has been dried, it is removed from the substructure to be recycled into organic, safe and nutrient rich fertilizer.



Picture courtesy of Betram Pty (Ltd)

Each unit comes equipped with a small water tank and basin for the washing of hands, ensuring personal hygiene. When you wash your hands, the water used is collected in a separate cistern beneath the basin. This water is then reused to clean the pedestal, similar to traditional flushing mechanisms. This dual functioning water system ensures the preservation of water, which remains a scarce resource in most developing and rural areas.

#### Components:

Sanitation systems in isolated or rural areas in South Africa are usually constructed as outdoor structures. These structures are subjected to the elements, including consistent sun exposure and moisture. The materials chosen must therefore be durable and able to withstand these harsh environments; without the need for additional maintenance and repair.



Picture courtesy of Betram Pty (Ltd)

For the Amalooloo sanitation system, the external structure is constructed out of precast reinforced concrete and the toilet system (seats, reservoirs and flushing mechanisms) are a durable plastic. All components are bolted together using stainless steel (304) fasteners and anti-theft bolts to ensure the structure is steady and sturdy.



Hand over of Amalooloo school sanitation solution with learners  
Picture courtesy of Betram Pty (Ltd)

The doors, door frame and metal trims are made from 3CR12. This assists to keep the product durable, not only due to its strength and corrosion resistance, but also rigidity to house the critical locking mechanisms that will not degrading over time, ensuring privacy and safety for the users.

Traditional pit latrine toilet systems use mild steel as the material of choice. Over time, the structures corrode and degrade when exposed to the elements. This requires regular refurbishments and or full replacement. Looking at the comparison with stainless steel, 3CR12 becomes the most competitive life cycle cost material of choice, without the need for additional maintenance and replacement of the product. This is the additional advantage for the Amalooloo sanitation system with offered longer product lifespan.

The Amalooloo Sanitation system is safe to use and easy to maintain. Transportation and assembly is done easily with the units being supplied in easy to assemble kit form. On-site construction of the units for large projects, like

sanitation systems in schools, takes between 5 to 10 days. Local community members are trained for the construction and installation of the sanitation systems, in doing so creating sustainable jobs and encouraging product ownership by these communities.

The benefits of the Amalooloo system:

- Addresses the socio-economic right for every person to have immediate access to an adequate, functional and dignified sanitation solution without sacrificing quality.
- Eco-friendly solution: Preserves natural resources, which is especially vital in water scarce regions.
- Empower communities: Provides an additional and sustainable income stream from the natural organic fertilizer by-product.

Additional sources:

How does the Amalooloo system work:

<https://www.youtube.com/watch?v=pJ4rza7-utY>

The Amalooloo App:

<https://www.youtube.com/watch?v=K80vmBkCOq0>

Amalooloo School Sanitation Launch:

<https://www.youtube.com/watch?v=UlqX85-tS4w>

## Action Review

**Specific;** Create a fully sustainable and affordable sanitation technology. The aim of the organization is to also bring about awareness not only of sanitation related topics but also overall health.

**Measurable;** Number of units per year; including Health Awareness Campaigns.

**Achievable;** Yes - ongoing commercial success.



**Realistic;** Yes; Supplied in excess of 30,000 structures since product's inception.

**Time-bound;** Ongoing.

## Horizontal Expansion Capability

Yes. The 3CR12 steel component (thickness) used in the Amalooloo system can be replicated for similar developmental applications, for example in roofing systems. Because of its affordable price and overall longevity, 3CR12 has become the cost effective material of choice for most sustainability projects in South Africa. The applications are endless.

## Outcome

Business efficiency: Creating a sustainable product stream for reclaimed thicker gauge cold rolled 3CR12 to a usable prime product. Thinner sections in 3CR12 are still a developing and growing market stream based on the continued success of this and other related application. This results in increases yield optimisation; whilst reducing inventory levels.



School girl washing hands inside the Amalooloo toilet  
Picture courtesy of Betram Pty (Ltd)



## Stilride Electric Scooter – Releasing the Full Potential of Flat Sheet Steel

<b>Member company</b>	<b>Outokumpu</b>
<b>Manufacturer</b>	<b>STILRIDE AB</b>
<b>Categories</b>	<b>original concept for production of or application of stainless steels; significant global market potential or reduction in operational costs; strong environmental improvement potential; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials</b>

### The Challenge

When you make a product you take a raw material and refine it to add value. Products where flat sheet steel are used as input material are often formed e.g. through roll forming, deep drawing, hydroforming etc. then joined together using various joining techniques. This has been the norm for centuries. Such techniques require investments in pressing tools and large machinery which often only pays off when very high-volume products are manufactured.

With Stilride we take advantage of the ancient origami technique (folding paper to a 3D object) to open up for complex designs by simply folding sheet into amazing 3D structures. Through the use of industrial origami we have the potential to reduce the number of parts needed for a product, reduce the need for joining of parts as well as creating a sustainable product based on stainless steel with



Picture courtesy of STILRIDE

unique shapes and forms.

At the same time the CO<sub>2</sub> levels are skyrocketing and climate change is a big problem. More scooters than cars are sold yearly and the old ones are more polluting than vans. Only 0.5% of the world can buy a car. Therefore we started out with the vision to build a sustainable electric scooter demonstrator of the technology. The mission is to create clean energy powered personal mobility devices through a flexible and sustainable production technology called industrial origami.



## Why?

STILRIDE wants to challenge the traditional view of manufacturing through the use of robotic industrial origami to fold structures from a flat sheet of metal true to the material's characteristics and geometric nature. The manufacturing technique developed for Stilride is centred around the ancient origami technique (folding paper to a 3D object). With this technique it is possible to achieve significant benefits compared to traditional forming technologies resulting in savings both in material use, processing through welding as well as labour costs.

## Needed Action

The idea was first realized in a research project and it has now taken the initial design of the STILRIDE electric scooter motorbike into a finished concept. In the process the project has demonstrated the method of designing and constructing using steel sheets as the raw material through industrial origami. To maximize weight reduction potential high strength stainless sheet material was chosen as the main construction material. This also meant that we had to overcome challenges related to folding of very high strength stainless steels. A methodology to locally heattreat the folding lines with laser was applied within the project.

The first prototypes of the STILRIDE electric scooter is now available to showcase. Next steps involve industrial pilot trials for complete automated production using the industrial origami manufacturing technique.

## Action Review

In 12 months STILRIDE has gone from concept to first prototype and in the process developed an alpha software version for enabling the digital value chain. By realizing the prototype we have analyzed the reduction of components. Compared to the industry leader in electronic scooters Niu, our chassi, reduced the number of components with approximately 75% and resulted in 25% lighter weight in comparison.



Pictures courtesy of STILRIDE



**Specific;** Designing and building a prototype e-scooter demonstrating the potential of the industrial origami manufacturing technique.

**Measurable;** Two demonstrator prototypes ready

**Achievable;** Piloted the production technology on prototypes and have resulted in strong KPIs (see outcome)

**Realistic;** Taken the technology from CAD to prototype

**Time-bound;** Within 12 months from start to finish

## Horizontal Expansion Capability

STILRIDE have successfully demonstrated an innovative way of processing metallic flat sheet material into complex geometries that would be costly to realize with traditional forming operations. It has the potential to create a new cost efficient value chain based on sheet metallic material that allows for manufacturers and mechanical engineering companies to design products to a substantially lower weight, using fewer components resulting in cost savings on material costs through large surface-to-volume ratios, high yield stresses and high fatigue resistance. The potential of this is huge for manufacturing in a more flexible way with metallic materials, especially for e-mobility and lightweight applications.



## Outcome

STILRIDE has in the product development of its electric scooter optimised the folding of flat sheet metallic materials for automated robotic manufacturing. This has resulted in a strong design DNA for an electric scooter made almost entirely in stainless steel.

Its process enables manufacturers and metal workshops to design structures containing remarkable physical properties that results in more lightweight

and cost-efficient products through flexible production for a circular economy. Resulting in lower manufacturing investment costs due to enabling tool-less production from metallic sheet material.

- In total we have shown that we can reduce weight with 25%
- We can decrease the number of components with 75%
- This will estimated create cost savings of 20 to 50%
- And decrease labor cost by 25-45% through less need for welding and riveting etc.





## Laser Welded Duplex Stainless (329J4L) Tube for Gas Gas Heater

**Member company** POSCO  
**Category** significant global market potential or reduction in operational costs

### The Challenge

In Korea, environmental facilities of thermal power plants are recently being upgraded to improve atmospheric environmental problems. In particular, plate heat exchangers that were applied to thermal power plants in the past are being replaced with tube heat exchangers due to the problem of flue gas leakage. For the tube heat exchanger, seamless duplex stainless steel tubes were mainly applied in Korea. However, the seamless duplex stainless steel tube is expensive and has a long delivery period, so heat exchanger manufacturers have requested the development of a welded tube with equivalent characteristics, low price, and short delivery time.

### Why?

The first reason for this challenge was to reduce the manufacturing cost of the customer, and the second reason was to expand the application field of our company's materials.

### Needed Action

First of all, we started by selecting the most suitable welding process from among various welding processes such as GTAW, ERW, LBW, etc., considering the characteristics, productivity, and price of the weld. Through comparison between welding processes, the LBW method was finally selected, and the welding and heat treatment conditions were optimized with a focus on improving the corrosion

resistance of the weld. In addition, in order to prove that the welded tube has characteristics equivalent to that of the seamless tube, various evaluation methods (ASTM G48A, C, D & Sulfuric Acid Dew Point Corrosion Test, Hydrochloric Acid Dew Point Corrosion Test etc.) were used. Particularly, in order to prove that the corrosion resistance of the welded part is equivalent to that of the base metal, after inducing artificial pitting electrochemically, it was proved that the frequency of pitting occurrence was the same in the base metal and the welded part as shown in Fig. 1.

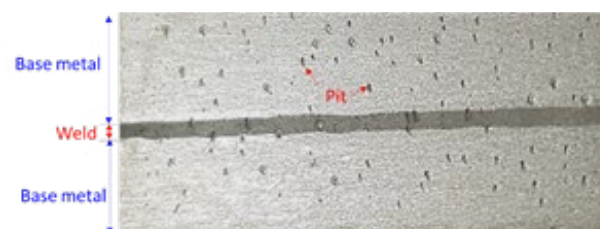


Fig.1 Appearance of pitting made electrochemically in weld and base metal  
 Courtesy of POSCO

In addition, a small sample was attached to the GGH (Gas Gas Heater) reheater of the Yeongheung thermal power plant in order to check the corrosion resistance in an actual environment. As a result of checking the sample condition one year later, the developed LBW tube was not damaged at all as shown in Fig. 2.

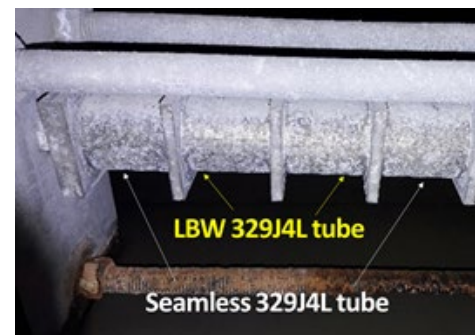


Fig. 2 Sample appearance after field test for 1 year  
 Courtesy of POSCO



## Action Review

It has been confirmed that this product can be mass-produced through laser welding and post-heat treatment by domestic manufacturing companies, and the corrosion resistance of the produced product meets the requirements of the customer through the ASTM corrosion evaluation method. The developed 329J4L LBW tube was applied to the GGH of a new thermal power plant in Samcheok, Korea.

## Horizontal Expansion Capability

This product can be widely applied to various industrial fields such as power plant, petrochemical, construction, and automobiles where seamless tubes are used.

## Outcome

The newly developed 329J4L LBW tube was applied to a new thermal power plant in Samcheok, Korea, and through this, GGH manufacturers were able to reduce manufacturing costs by more than 30% and shorten delivery time by 1.5 months. In addition, our company was able to expand the market area to the industrial field where seamless tubes are used.



Fig. 3 GGH bundle made by 329J4L LBW tube  
Courtesy of POSCO





## INAMESA Stainless Steel CNC Bridge Slot Water Well Screen

**Member company**  
**Categories**

**Acerinox**  
**significant global market potential;**  
**strong environmental improvement**  
**potential; GHG emissions reduction;**  
**preservation of scarce resources;**  
**reduction in routine maintenance**  
**costs; life cycle costs lowest**  
**compared to competing materials**

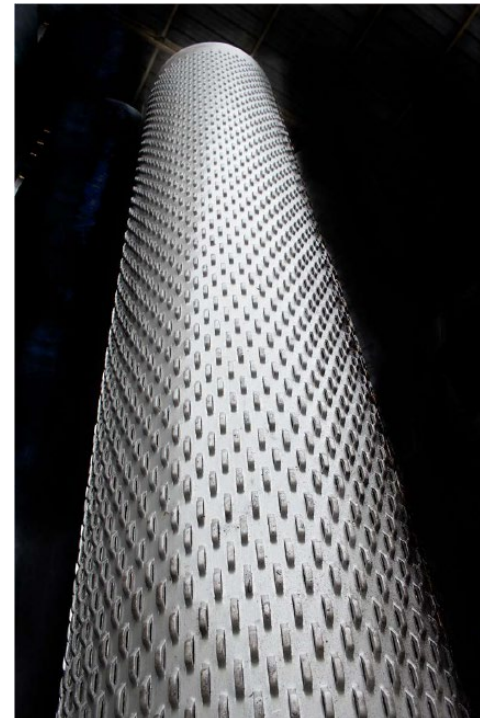
### The Challenge

Water worldwide is increasingly becoming a more scarce resource. Large quantities of water used for human, industrial and agricultural consumption come from wells, which need screens to pre-filter it. The Gold Industry standard for these screens is the Stainless Steel based Continuous Slot type. For most developing countries however, this type of screen is cost prohibitive and for this reason, two reduced price alternatives have emerged, the louver and the bridge type, both of which rely on standard steel as well as copper based alloys which have been proven to be harmful to the environment and not as corrosion resistant as the Continuous Slot one. Additionally, many of these cheaper solutions are done using a semi manual process, which cannot guarantee strength and water flow requirements.

INAMESA has spent years improving the bridge type design using CNC (Computer Based Control) tools to ensure a consistent set of characteristics for each screen that is manufactured. Based on several studies testing water flow and structural resistance among other parameters, and backed by renowned industry certifying

agencies as well as a patent backing the uniqueness of such design, came up with an innovative improvement that makes this inexpensive option and excellent alternative to the Continuous Slot Screen.

In addition to the screen itself, a stainless steel industrial bristle brush based cleaning mechanism has also been developed to help with the cleaning as part of the standard maintenance needed in order to increase the life expectancy of the product.



Pictures courtesy of INAMESA



## Why?

Significant cost reduction when compared to the alternatives, increase in sales and revenues, less harmful for the environment, better life cycle management and maintenance, less pollution as most competing products have to be imported which greatly increased the CO<sub>2</sub> emissions from transportation thus reducing our overall carbon footprint. It also helps develop the local economy.

## Needed Action

We started from a proven design and based on experience and technical knowledge began tweaking the main parameters such as thickness of the screen, slot height, width, etc. until finally arriving to the optimal design that had to also take into account the manufacturability of the product.

After this we undertook several tests with local renowned institutions to verify our work as well as obtaining certifications from leading international inspection, verification and testing organizations and obtained a patent to back our findings.

Since the screens are manufactured using CNC equipment, we can guarantee that the engineering design tolerance will ensure that the performance will be as specified, and therefore, allow us to certify such products.

## Action Review

**Specific;** Need a design that could compete in terms of durability, strength, water flow.

**Measurable;** Corrosion resistance, flow and strength that rivals the best in the industry

**Achievable;** The product has been proven in the field by several of our customers



Picture courtesy of INAMESA

**Realistic;** There was already a much more expensive Industry Gold Standard to which to compare

**Time-bound;** The project was paced to achieve milestones in terms of increasing depths of wells. We are currently at the 200-meter depth mark and plan to be at the 300 plus mark before the end of the year.



## Horizontal Expansion Capability

Scale up in order to be able to get to greater depths of wells and develop new applications around it such as the stainless steel brushes for maintenance. One option for example would be accessories for better handling and placement of the screens at the well sites.

## Outcome

Predictability of outcome when compared to low-end solutions. Based on our studies and design, we can certify our product for a specific well depth, water flow, expected life, and other important parameters.

Significant price reduction when compared to high-end solutions.

Increase in sales, better inventory level management, as there is less reliance on imported goods.



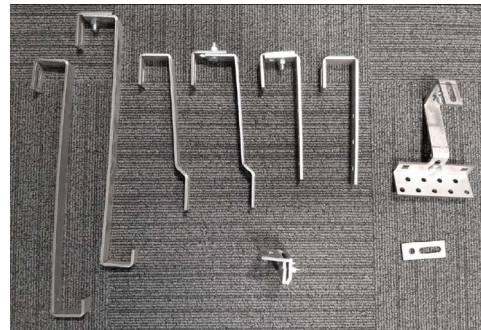
## Investa Solar Panels Construction Elements

Member company  
Categories

**Acerinox**  
promotes a bespoke or non-standard grade; GHG emission reduction; reduction in routine maintenance costs; life cycle costs lowest compared to competing materials

### The Challenge

To provide Investa with materials that will help modernise Polish electrical energy production sector become more eco-friendly. Delivery of HR 1.4016 sheets and strips.



Pictures courtesy of Investa

### Why?

Nowadays Poland and whole EU focus on environmental friendly solutions for electricity production. It becomes more and more popular to install on private roofs solar panel the same as to construct big solar farms. To be profitable such installations should be in service for at least 7-10 years and in many cases they should work for over 25 years. This implies to use durable and easy to work with materials. Grade 1.4016 provides enough corrosion resistance for this application so that the installation could endure many years in service. Its mechanical features are well known in the market.

### Needed Action

Already in use.

### Action Review

**Specific;** solar panels construction elements.

**Measurable;**

**Achievable;** product is already in use and becomes more popular with time

**Realistic;** Already developed and in use

**Time-bound;** Being used

### Outcome

The solar panel sector required materials that were know in processing, that would last for many years and that would relatively cheap. This was achieved thanks to application of HR sheets and strips in 1.4016 grade.

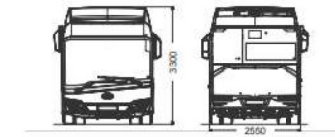
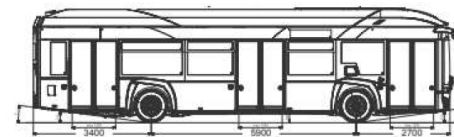


## Solaris – Hydrogen Bus Chassis/Bodyframes

Member company	Acerinox
Categories	GHG emissions reduction; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials

### The Challenge

GHG emission is a great concern for EU countries and for Acerinox Group. We wanted to support one of the biggest producers of buses in EU in their project to build an eco-friendly **Urbino 12 hydrogen bus**. (Delivery of HR and CR sheets in grade 1.4003).



### Why?

Europe these days is more and more environmental aware. The EU looks for more sustainable eco-friendly solutions. We wanted to contribute to this process and support one of the biggest bus producers in Europe in their project to build low-emission bus.

Stainless steel is used in construction of the body structure. It ensures ideal weight and durability of the bodyframe and perfectly faces up to challenging road and weather conditions in different climate zones. The skeleton made of 1.4003



stainless steel helps to increase rigidity, ensure resistance to vibrations, and reduce noise levels.

### **Needed Action**

It is already in use.

### **Action Review**

It is already in use.

## **Horizontal Expansion Capability**

Reducing GHG is a global concern; therefore, this application can be expanded elsewhere.

### **Outcome**

Stainless proved to be the perfect solution for this sustainable purpose.



## Stainless Steel ERG Cooler

**Member company** Acerinox  
**Categories** strong environmental improvement potential; GHG emissions reduction

### The Challenge

Our Stainless Steel for this application of EGR Cooler is a solution of Life-Cycle Costs, Lowest Maintenance, High Performance, Durability , and Corrosion Resistant.



Pictures courtesy of Acerinox Thailand

### Why?

EGR Cooler (Exhaust Gas Recirculation ) valves were developed as a way to improve overall emissions performance, reducing peak combustion temperatures and in turn , lowering the amount of NOx gases (Nitrous Oxide ) produced by an engine during operation.

### Needed Action

No actions needed. This application is already in use thanks to Acerinox Material.

### Action Review

**Specific;**

**Measurable;** This new ERG cooler is able to reduce NOx

**Achievable;** Application already in use

**Realistic;** Application already in use

**Time-bound;** Application already in use

### Horizontal Expansion Capability

Reducing GHG is necessary, and for the automotive industry is a must. This new application in Thailand based on stainless steels brings a new scenario for this environmental aim.

This is another example of how stainless steel can promote a sustainable automotive industry, not only in terms of emissions but also in weight and life cycle cost.

# AICHI STEEL

## Vertical Greening Cylinders (Vertical Forest®) Using Stainless Steel at Aichi International Convention & Exhibition Center

Member company	Aichi Steel
Category	original application concept for stainless steels

### The Challenge

We would like to inherit the environmental efforts of Aichi Prefecture that were seen at the "EXPO 2005 AICHI JAPAN" and create a symbolic space that provides visitors with a variety of flowers throughout the four seasons. To realize the concept, we planned to hang 45 vertical greening cylinders (Vertical Forest®) with a length of 9 m from the large approach eaves with a length of 200 m and a height of 11.5 m, which constitutes the main gate of the International Convention & Exhibition Center.

### Why?

The construction site of the International Convention & Exhibition Center is located on an airport island, making high wind pressure resistance and salt damage resistance mandatory. The vertical greening cylinders are designed to be always in a humid environment due to irrigation, making it mandatory to select materials with particularly high weather resistance.

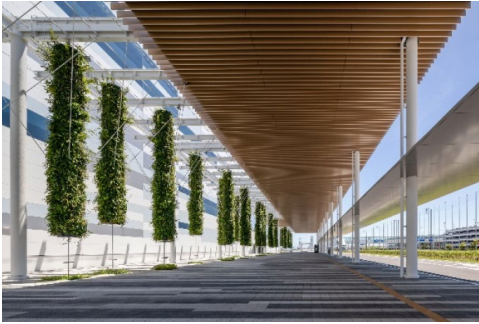


Picture courtesy of Aichi Steel Corporation

### Needed Action

To reduce the amount of water that the steel material is exposed to, the green cylinder is hollowed out to allow air to pass through. This structure is achieved by separating a ring that supports the greening panels from the mandrel. The mandrel is made of 350 φ stainless steel pipe (t = 9 mm) and supported by an anti-sway rod (M28) extended in four horizontal directions to withstand the lateral force brought by earthquake or strong wind. A ring-like support made of stainless steel channel is provided to support the ring. It is extended in three directions from the mandrel. The greening panels are bolted to the support. Applying such a structural system can minimize the area in contact with the





Pictures courtesy of Aichi Steel Corporation

moisture-rich greening panels and reduce the weight of the support frame.

The ring that supports the mandrel and the greening panels is difficult to maintain, so we planned to manufacture it from stainless steel, which has excellent weather resistance. The anti-sway rod and the hanging bracket, are made of general hot dip galvanized steel because they are exposed, but an insulating region was provided to prevent corrosion due to contact with dissimilar metals. The mandrel, the main structure, is made of a stainless steel pipe of SUS316A, which is a designated building material. The ring that supports the greening panels is made of angle stainless steel of SUS316. A total of about 70 tons of stainless steel is used.

## Action Review

**Specific:** The verification was carried out as per the Building Standards Act.

**Measurable:** To verify the performance of the entire vertical greening structure, six vertical greening cylinders (Vertical Forest<sup>®</sup>) were erected in advance under the large approach eaves constituting a subgate, and the growing state of the plants was consistently observed for about one year under the same condition as

at the time of completion.

**Achievable:** The same as above.

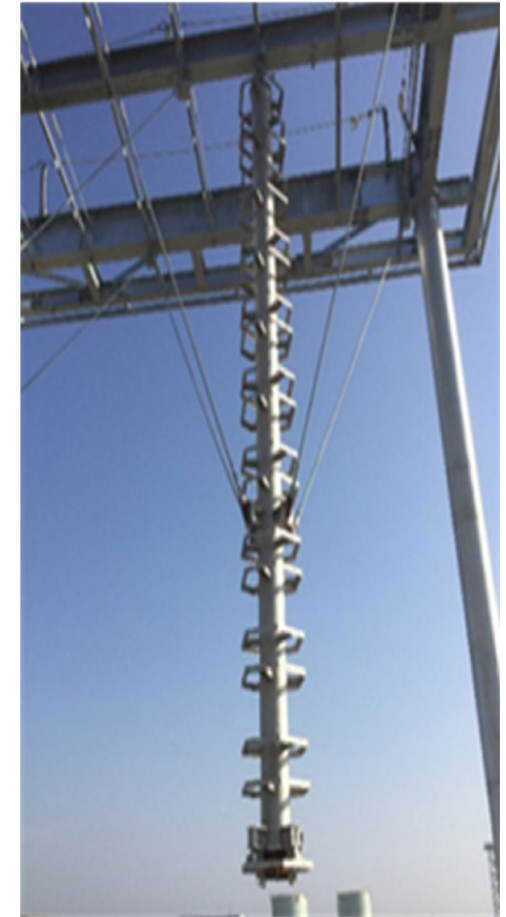
**Realistic:** In 2018, the site was hit by a storm with a maximum instantaneous wind speed of 46 m/s due to the Typhoon Jebi, but had no structural problem. We confirmed that the structure had sufficient wind resistance.

**Time-bound:** The structure was designed and constructed by Takenaka Corporation, completed in June 2019 as planned, and opened on August 30, 2019.

## Horizontal Expansion Capability

We were able to identify specific issues and solutions to the extent that we can horizontally expand the structure.

Under the conditions that require high wind pressure resistance and salt damage resistance, this structure has various elements that can be referred to, such as material selection and the provision of an insulating region to prevent corrosion due to contact with different metals.





## Outcome

In selecting materials, we considered non-stainless steel, such as hot dip galvanized steel and coated steel, and the grade of stainless steel. We also examined what the quality assurance, maintenance costs and operating loss during the maintenance period would be if we had adopted non-stainless steel for difficult-to-maintain parts inside the greening cylinders. As a result of the examination, we finally adopted SUS316A and SUS316 stainless steel. For cost and inventory levels, we had a detailed discussion about processes for stable supply. This allowed us to proceed smoothly with factory production and site construction as planned.



Pictures courtesy of Aichi Steel Corporation



## Carbonization Furnace Doors

<b>Member company</b>	<b>Aperam</b>
<b>Categories</b>	<b>original application concept for stainless steel; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials</b>

### The Challenge

In Brazil, charcoal plays an essential role in several industries. This includes the steel industry, which is the biggest user of charcoal. Because of this demand, the carbonization process, particularly its technological evolution, are important to the charcoal supply chain.

One reason charcoal is such a popular material is that it is completely sustainable. Because charcoal comes from forests, mainly eucalyptus forests, both the charcoal itself and the energy it produces are considered to be 'green'.

Transforming eucalyptus wood into charcoal is done via a high-temperature carbonization furnace. The carbonization furnace located at Aperam's Bioengeria operations in Brazil used a carbon steel door. However, due to the corrosivity of tar oil, combined with the high temperatures, these doors were susceptible to corrosion. As a result, annual – and expensive – maintenance was required.

### Why?

The challenge was to find a suitable material that could guarantee better corrosion resistance, thus eliminating the need for costly repairs.



Pictures courtesy of Aperam

### Needed Action

Based on the company's in-depth knowledge of the carbonization process, it was determined that 410 grade of stainless steel offered the right mechanical properties for reducing the weight of the door and thus improving its corrosion resistance.



## Action Review

**Specific:** Yes. The goal was to reduce maintenance costs and downtime and to achieve a positive LCC.

**Measurable:** Yes. Maintenance costs and performance of the stainless steel door was tracked using a scheduled and continuous inspection routine.

**Achievable:** Yes. Aperam South America and Aperam Bioenergia provided all the resources needed to achieve this goal.

**Realistic:** Yes. Thanks to the use of a previously conducted analysis, the initial expectation was very reasonable.

**Time-bound.** Yes. The carbon steel door required annual maintenance.

## Horizontal Expansion Capability

Yes, this new application is expected to significantly expand the stainless steel market, replacing the demand for carbonization furnace doors made of other materials (masonry and carbon steel, for example).

## Outcome

Stainless steel furnace doors offer many advantages:

- Significant increase in lifespan, lasting at least 3 times longer than other materials.
- Major reduction in maintenance cost (about 20%).
- Increased productivity thanks to fewer maintenance stops (which were previously an annual occurrence).
- Reduced weight of the door makes it easier to load the furnace.
- A promising market for the use of stainless steel.



Pictures courtesy of Aperam



## Stainless Drum Returnable

**Member company**  
**Categories**

**Aperam**  
original concept application for stainless steels; strong environmental improvement potential; preservation of scarce resources; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials

### The Challenge

New application in Brazil with stainless steel for the packaging sector, these are drums for storage and transportation of products, which were previously manufactured in carbon steel or plastic.

The Stainless Steel Drum can be used in industry in several segments, as it performs the transport and storage of the components in a cleaner and safer way, is lighter, in addition to increasing the service life due to greater resistance to corrosion, allowing reuse the drum (reverse logistic).

The stainless steel defined in this application was the 430DDQ, which has as main characteristics, special mechanical properties for deep drawing where the manufacturing processes of the drums are required, the 430DDQ is known for its high gloss, being the highest of the ferritic stainless in the portfolio Aperam, differentiating itself both aesthetically and technically, thus being a competitive ferritic solution from Aperam in this application.



Picture courtesy of Aperam



The biggest challenge in this project is to show the industry that in addition to the stainless steel drums being a competitive solution, as it has greater resistance to corrosion and greater durability, it can reduce the disposal of products as they occur with substitutes such as carbon steel and plastic, which contributes for less environmental impact and circular economy.

## Why?

We have several advantages due to the versatility of stainless steel in this application, the main ones being the reduction of thickness (reducing the weight of the drum by up to 23%), making the drums lighter for transportation and greater resistance to corrosion inherent to stainless steel compared to other materials.

## Needed Action

Assess what the customer's requirement would be regarding the manufacture of stainless steel drums, identifying their properties and making a selection of materials to identify the most suitable stainless steel for each type of product to be transported, carrying out analysis of the transported product sheet. Project monitoring, prototyping and standard evaluation for inclusion of stainless steel.

## Action Review

**Specific;** To reduce the thickness and reduce corrosion on critical devices. To obtain that, we involved all development teams of Aperam and customers. The goal was to find a financially feasible and technically sustainable solution. Reduction of environmental impact by applying a more durable product, considering that substitute products such as plastic and carbon steel ending durability could be discarded in the environment, increasing the environmental impact.

**Measurable;** We tried to be as close as possible to the original equipment

assembling budget and decided to measure wall thickness annually, and we scheduled a continuous inspection routine during the production.

**Achievable;** To make the goals attainable, Aperam and the customer decided to provide the necessary resources and specific teams trained to identify any abnormality. That was the paramount commitment of this partnership;

**Realistic;** Initially, our goal was to reduce the thickness, reduce roughness with the application of stainless steel to facilitate the cleaning procedure and increase corrosion resistance in the application.

## Horizontal Expansion Capability

The Stainless Steel Drum can be used in industry in several segments, as it performs the transport and storage of the components in a cleaner and safer way, is lighter, in addition to increasing the service life due to greater resistance to corrosion, allowing reuse of the drum.

## Outcome

- Higher corrosion resistance
- Thickness reduction
- Better aesthetic appeal
- Greater ease of cleaning
- Less roughness
- Reverse logistics (reuse of drums)
- Circular economy



## Stainless Steel Intermediate Conveyor Chains in Sugar & Ethanol Industries

<b>Member company</b>	<b>Aperam</b>
<b>Categories</b>	<b>reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials</b>

### The Challenge

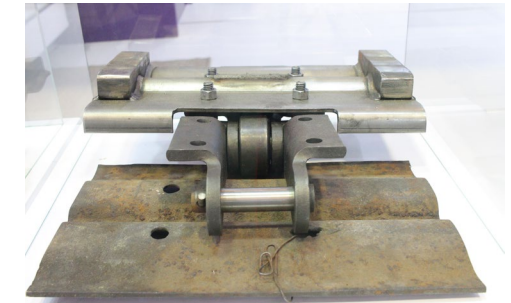
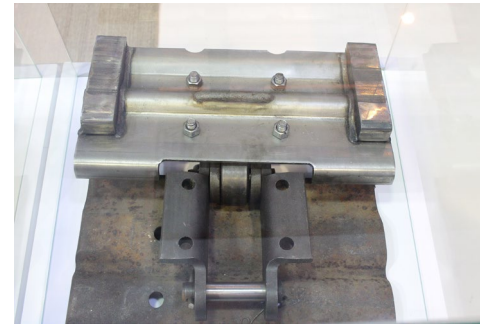
Increased chain lifespan from 1 season to 2 with no sidebar maintenance and limited replacement of pins and bushing. Typically, intermediate cane conveyor chains are manufactured with heat treated ASTM 1045 carbon steel. However, due to wear, tear and corrosion, this material quickly fails. It also results in extreme thickness loss, mainly between the pin and the bushing.

### Why?

Every season, sugar and ethanol mills spend a lot of money either refurbishing or buying a new conveyor chain set (sides, pins, bushings). They also make frequent programmed stops to adjust the chains. This equipment is critical to the mill's processes and any failure completely stops of all sugar and ethanol production.

### Needed Action

To resolve the problem, we tested the use of heat treated 410D grade (DIN 1.4003) stainless steel. After two seasons there was no sign of thickness loss on the side bars.



Pictures courtesy of Aperam

### Action Review

**Specific:** To reduce wear and corrosion on cane carrier chains in general and side bars specifically. To succeed, we work together with the customer, a chain producer and Aperam's team.

**Measurable:** We decided to apply a stainless steel grade with mechanical properties equal to or higher than ASTM 1045 and offering better corrosion and wear resistance than carbon steel. Our criteria measurement was thickness.

**Achievable:** Every season we rescued chain samples to measure.

**Realistic:** Our initial goals was to achieve a minimum twofold increase in the machine's lifespan, which is very reasonable considering our previous analysis.

**Time-bound:** Intermediate Cane conveyor chains are very critical to sugar and ethanol production. Every season, sometimes in the middle of the season, these chains must be repaired. It's reasonable to test this application over the course



of three seasons. We built a prototype in 2018 and proceeded with measurements every off season until 2020.

## Horizontal Expansion Capability

Yes, it can. Conveyor chains are used for some industries like grains. It is perfectly possible to expand this application to the grain segment (soybean, corn, etc.)

## Outcome

The first benefit is the increase in lifespan. We already improved chain performance from 1 season (ASTM 1045 carbon steel) to 3 (410-DIN 1.4003), and we believe it's possible to extend this to 4 seasons.

Looking inside the bushings and comparing the side bars made from carbon and stainless steel, the surface of the carbon steel side bars was heterogeneous. This is because corrosion from the carbon steel side bars was present between the pins and the bushings. Corrosion is very hard and abrasive material and may explain the distinct peaks and valleys found in the chart.

Checking the external surface of the bushings, we could see that corrosion was present where carbon steel side bars were. This wasn't the case with the stainless steel side bars. In other words, removing samples from the carbon and stainless steel side bars, we were able to verify that the carbon steel sample's edges were completely damaged from corrosion, whereas the stainless steel sample's edges were unaffected.

As to maintenance costs, it is possible to achieve a 26% cost reduction.





## Expanded Sheet for Mining

<b>Member company</b>	<b>Aperam</b>
<b>Categories</b>	<b>original application concept for stainless steels; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials</b>

### The Challenge

Expanded sheets are made of a mesh and feature a flat steel opening. Because the material greatly exceeds its original size, this design allows for lower cost per product area. These sheets are used for industrial partitions; to protect machinery; as grids, floor plates, and filter elements; and for such structural applications as walkways and industrial platforms.

In the mining segment, the use of 410 grade of stainless steel in expanded sheets has significant potential – mainly due to its high corrosion resistance and abrasion in humid environments. Since stainless steel is not susceptible to widespread corrosion like carbon steel is, it allows for a significant reduction in thickness level. Offering a much longer lifespan and more security to the structure, stainless steel is a highly competitive material in this segment.

### Why?

Carbon steel's corrosion problem is particularly prevalent in the platforms used by mining companies. Here, we saw an opportunity to test the use of 410 grade of stainless steel as a competitive alternative solution that, by improving the structure's durability, would increase its overall safety.



Pictures courtesy of Aperam

### Needed Action

Both stainless steel and carbon steel platforms were installed in the same humid and abrasive environments. We then compared their corrosion resistance and measured their thicknesses over a period of three years.

### Action Review

**Specific:** To reduce wear and corrosion on critical devices. To do this, we involved all Aperam's development teams, along with those of our customers. The goal was to find a financially feasible and technically sustainable solution.

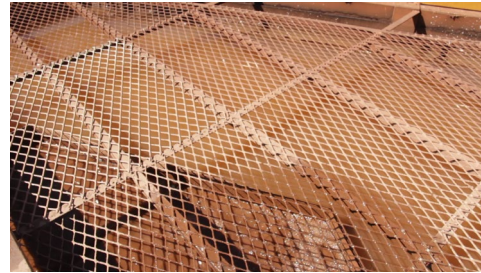
**Measurable:** We tried to be as close as possible to the original equipment, including in terms of budget. We measured wall thickness annually and scheduled a continuous corrosion inspection routine.

**Achievable:** To make the goals attainable, Aperam and the customer decided to provide the necessary resources and train specific teams to identify any



abnormalities. That was a paramount commitment of this partnership.

**Realistic:** Initially, our goal was to achieve a minimum threefold increase in the machine's lifespan, which is very reasonable considering our previous analysis.



Pictures courtesy of Aperam

## Horizontal Expansion Capability

These sheets are used by the oil, sugar and alcohol, and mining industries for industrial partitions; to protect machinery; as grids, floor plates, and filter elements; and for such structural applications as walkways and industrial platforms.

### Outcome

- 410 grade of stainless steel is approximately 3x more durable than carbon steel
- Fewer bucket changes
- Reduced maintenance
- Reduction in thickness
- Increased safety for industrial plants



## JAMOTEC Ham Holders

**Member company**  
**Categories**

**Cedinox**  
**original application concept for**  
**stainless steels**

### The Challenge

Jamotec, S.L. was founded in 1994 as a specialized company for 'ham holders' for the food industry and butcher's. Their management and technical team invented and patented the 'Rolling Disc System', which was a global innovation at the time. The mechanics of this innovative system is extremely reliable and precise, allowing the ham cutter to slice the ham in a comfortable and fast way



as never seen before. The stainless steel in the professional line does not almost wear, even when used intensively. As proven in the tests conducted in their facilities, the approximate wear of these parts is potentially a tenth of a millimetre in twenty five years. F2 Rocker and F2+ Rocker are their latest achievements, they are both entirely made of stainless steel and include cutting edge disc rolling, innovative tilting system and new Jamotec® support. They do not need maintenance, are easy to clean even loaded into the dishwasher. In addition, F2+ Rocker model has a genuine bidirectional fully rotational system.

### Why?

Stainless steel is already known as a hygienic material; therefore, it is used in the food industry.

The main goal was to join tradition and aesthetics into a ham holder.





## Needed Action

Many designs were made in order to achieve the final result.

This device was tested and proved by many specialists and end users before its definitive approval.

## Horizontal Expansion Capability

Even if Spanish Ham is a national tradition, it is being more and more accepted worldwide and those kinds of devices are excellent wherever you have a Spanish Ham.

## Outcome

There are many benefits contained in this application.

First, the durability, and of course it is easy to clean and to work with.

In addition, the aesthetic design brings elegance to every restaurant where this Ham holder is placed.

## Jorge Juan 53 Main Entrance

<b>Member company</b>	<b>Cedinox</b>
<b>Categories</b>	<b>GHG emissions reduction; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials</b>

### The Challenge

Jorge Juan 53 is a unique residential concept in the heart of Madrid. Ortiz León Architects have developed the project. One of the reference European studies, established in Madrid since 1984, with offices in Miami and Shanghai. Sustainability, innovation, durability and well-being are the foundations on which the design of Jorge Juan 53 is based. Only 6 homes, one per floor plus the 3 stories penthouse with great terraces. The post-tensioned concrete structure allows large open spaces to magnify the natural light and multiply the layout possibilities. The presence of the garden designed by prestigious Landscape Architect Jesús Moraima, is seen from all angles, through the transparent walls of the spectacular lobby with glass and AISI 316 stainless steel door and from each of the homes. Private entrance halls to the apartments are finished with stainless steel cladding to the lift elevation.

### Why?

Jorge Juan 53 is a nice example of urban edification with sustainable and maintenance free materials such as AISI 316L. Many times stainless steel seems to be related to new buildings in business areas but it could also be placed in a new building located in an existing and traditional one. It also reflects the versatility of stainless steel and all the products you can

obtain. In this building, you can find sheets, bars, wire mesh among many other stainless steel products such as bolts, for instance.

### Needed Action

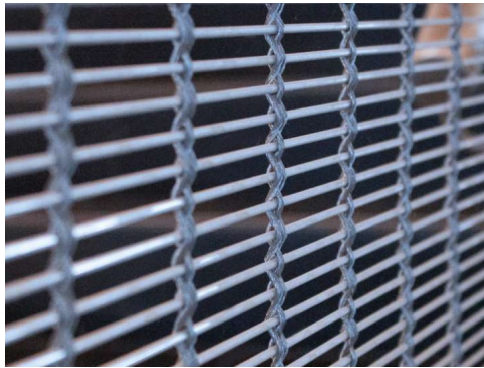
Visiting architects with different examples of how stainless steel could fulfil their requirements, not only from the non-corrosion point of view



Pictures courtesy of Jorge Juan 53



but also from the aesthetical or low maintenance one. Betting also for sustainable materials like stainless steel should be necessary in those kinds of interventions.



Picture courtesy of Jorge Juan 53

## Action Review

**Specific;** Installation of stainless steel in specific sites

**Measurable;** Maintenance will be lower

**Achievable;** Material already installed

**Time-bound;** Finished

## Horizontal Expansion Capability

Restoration and rehabilitation of ancient buildings all around the world.

## Outcome

Stainless steel is a noble material, therefore it looks bright and elegant when you place it at the main entrance of a building.

Stainless steel can be a perfect ally in terms of sustainability. Thanks to its sustainable properties (recyclability, low GER, longer life etc.) the sustainability parameters of the building could be increased to obtain different LEED certificates.



Picture courtesy of Jorge Juan 53



## “What a Mesh” Stainless Steel Jewellery

**Member company** Cedinox  
**Category** original application concept for stainless steels

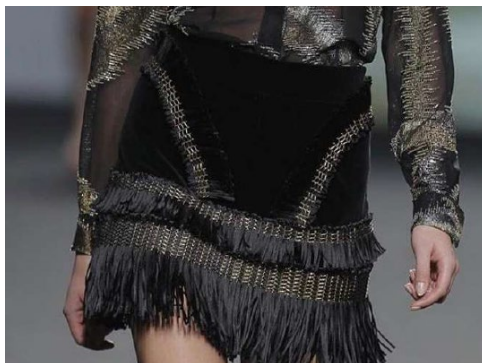
### The Challenge

The industrial legacy and passion for beauty of this company have brought “What a mesh”, new artisan jewellers.

They reinvented their industrial product creating precise and elegant jewels. Craftsmanship and sustainability are basic pillars for “What a mesh”, that is why they use stainless steel, for its resistance, durability and recyclability.



Picture courtesy of Cedinox



Picture courtesy of Cedinox

### Why?

Stainless steel is an aesthetic material, therefore... why not using it for fashion and jewellery?

### Needed Action

The main challenge was to start production and proved to custom designers that stainless steel mesh is a product to rely on.



Picture courtesy of Cedinox

### Horizontal Expansion Capability

Many different grades and finishes , also colours, can be used for this application.

### Outcome

Right now, it is a niche, but could create tendency in fashion.



## THIELMANN PORTINOX Disinfecting Sanitary System

**Member company**  
**Categories**

**Cedinox**  
**original application concept for stainless steels; significant global market potential; strong environmental improvement potential; life-cycle costs lowest compared to competing materials**

### The Challenge

THIELMANN PORTINOX has developed a complete and wide range of disinfecting sanitary systems entirely manufactured in stainless steel AISI 304, which makes them functional, easy to install, durable, hygienic and easy cleaning. Their attractive and ergonomic design is key to suit any possible area of application such as sports, industrial, commercial, sanitary or public facilities among others. All models include a child safety device that avoids accidental ingestion and a drip tray stamped in a single unit with bright mirror finish that avoids bacterial growths and helps easy cleaning. Depending on the use, it can be freestanding, foot-tower or sensor-controlled to avoid any contact.



Picture courtesy of THIELMANN PORTINOX

### Why?

The current pandemic situation claims for hygienic solutions made with hygienic materials. THIELMANN PORTINOX proposal combines both and it is an excellent example of production knowledge and stainless versatility.

### Needed Action

This application is already in use.

### Action Review

**Specific;** Sanitary systems made of stainless steel.

**Achievable;** Product is available for anyone

**Realistic;** Already developed and in use

**Time-bound;** Being used

### Outcome

Stainless steel has many advantages apart from the world known "corrosion resistance". The hygienic properties of stainless steel are already proved and examples like this helps people to understand its many applications. THIELMANN PORTINOX was able to join sustainability, non-corrosion resistance and hygiene into a single disinfection sanitary system.



Picture courtesy of THIELMANN PORTINOX



# Industeel

## Superduplex Sintering Plant Chimney

Member company

Industeel

Categories

original application concept for stainless steels; life-cycle costs lowest compared to competing materials

### The Challenge

Corrosion issues with a Corten chimney due to acid condensation at colder places due to insulation defects.

We helped the designer and owner for the design in Superduplex that reduces the investment cost compared to other solutions in carbon steel or concrete.

<https://industeel.arcelormittal.com/news/new-application-for-superduplex-ur2507/>

### Why?

We already had contact with the maintenance team of the plant for other project related to corrosion, therefore they submit their problematic of corrosion with the chimney.

We understood that if we could solve the corrosion issue with a simpler design without insulation stainless steel could be competitive.

### Needed Action

Help the owner for writing the specification, give data for corrosion warranty.



Pictures courtesy of ArcelorMittal Industeel

Give inputs to the designer for the construction code interpretation, it was its first Superduplex design.

Support the constructor for welding qualification, it was its first Superduplex project.



## Action Review

**Specific;** yes, see above. Each project participant had a specific need

**Measurable;** yes, we can find all our inputs in email and/or minutes of meetings

**Achievable;** yes, dimensions and properties + fabrication where documented

**Realistic;** yes, first budget evaluation shows that the idea was feasible

**Time-bound;** yes, the chimney has been replaced at summer maintenance as planned

## Horizontal Expansion Capability

Take time to understand the customer problematic, build a confidence climate to get all necessary info.

Anticipate technical hurdles, propose technical assistance since the beginning.



## Exterior Cladding for U.S. Army Museum

Member company  
Categories

North American Stainless  
reduction in routine maintenance  
costs; life-cycle costs lowest  
compared to competing materials

### The Challenge

The architects were trying to achieve a modern look to the outside of the building that would also entail long term cost savings as a result of a longer product life cycle.

### Exterior Cladding for U.S. Army Museum

Located 20 miles south of Washington D.C. on a hilltop within the Fort Belvoir Military Installation, the Army Museum Building Complex stands out with its futuristic clean design. The Stainless Steel exterior cladding made of NAS T316L sheets truly shines, a reflection of past strength of the U.S. Army and its bright future. The museum designed by the renowned architecture firm of "Skidmore, Owings & Merrill" will be considered one of the Army's National Landmarks. The design includes five pavilions that include galleries, a cafe, retail space, 360\* theater, Veterans Hall and three terraced gardens. One of the design features that sets the museum apart is the reflective metal cladding that covers most of the exterior surfaces. It comprises 110,000 square feet of wall panels made from T316L grade that was supplied almost entirely by NAS, with a 2D finish and further polishing into a reflective #6 long grain satin polish being applied by another processor before delivery to the construction site. NAS supplied the material in 1/8 inch thick coil form in 36" wide, which was further cut into panels 3ft wide and up to 20 feet in length.



Picture courtesy of North American Stainless

The decision to make the panels in Stainless Steel T316L was the result of needing to meet strict requirements related to corrosion resistance that would reduce long term maintenance costs, as well as taking into consideration the thermal expansion and contraction of T316L grade as well as its excellent resistance to extreme temperatures when compared to other metals.

The goal of the architects as stated by SOM partner, Colin Koop was to "reduce the overall carbon impact of the new museum while creating a high performance building". Design features as well as the high-recycled content of the stainless steel supplied by NAS, resulted in the project receiving the LEED Silver Certification, thus highlighting the commitment to the environment.



## Why?

As a signature building for the U.S. Army the cladding to be used on the outside of the building needed to portray the modern look desired by the U.S. Army and long term maintenance costs had to be reduced with the choice of material.



Picture courtesy of North American Stainless

## Needed Action

The material chosen to address the issue of lower long term maintenance cost was T316L stainless

steel due to the high corrosion resistance to the elements, the panels used were polished so as to give the clean modern look required.

## Action Review

**Specific;** Desired modern look was achieved as required by the U.S. Army

**Measurable;** Long term maintenance costs savings will be measurable over time

## Horizontal Expansion Capability

Use of T316L cladding for buildings can be expanded to future buildings to replicate benefits noted.

## Outcome

Quality of panels was observed by U.S. Army to have achieved requirements set forth for the project. Cost savings on maintenance will be observable over the future years.



## Stainless Steel Channels for Seattle's Space Needle

**Member company  
Categories**

**North American Stainless  
reduction in routine maintenance  
costs; life-cycle costs lowest  
compared to competing materials**

### The Challenge

Renovation of exterior of Seattle's Space Needle with long lasting materials

#### CUSTOM STAINLESS STEEL CHANNELS FOR SEATTLE'S SPACE NEEDLE OBSERVATION DECK

The "Space Needle" in Seattle, Washington, is one of the most recognized landmarks in the U.S. and a main attraction for the city of Seattle. Built in the early sixties, after 57 years it became clear that it was in need of renovation. The remodeling project focused on giving the visitors an enhanced experience, providing unparalleled 360 degree views of the city and Puget Sound. Emphasis was placed by the design team led by Design Principal Alan Masking on achieving a greater transparency with an observation deck where the former wire caging would be substituted with new glass barriers, tilted outward to match the angle of the building.

With the incorporation of the glass barriers on the 520 ft tall observation deck, the comparable visibility was enhanced by 35%. The specific design of the barrier called for the installation of 48 glass panels, using 2 inch thick glass, measuring 7 feet wide and 11 feet high with a weight per panel of 1 ton. Due to the size and thickness of the glass panels, the materials used for the fitted shoe of the glass was critical. With the observation deck being exposed to the elements, the use of stainless steel was considered as the most viable option for the profiles that



Picture courtesy of Stainless Structural

would be needed. T316L grade was chosen for its excellent corrosion resistance combined with the mechanical properties required for the application.

The company tasked with the installation of the glass panels, Herzog Glass, reached out to Stainless Structural to produce custom profiles for bracing the glass panels with T316L grade produced at NAS. It was determined that the best production method for the shapes needed was the technique of laser fusion which



allows for customization of shapes, and sizes. The shoes produced with the profiles have the unique feature that there is no mullion or frame between the panels, thus allowing for an unobstructed view all the way around the observation deck.

NAS is proud to have partnered with Stainless Structural and be able to participate in the renovation project of such a historic landmark, helping to enhance the visitor experience for many years to come.



Picture courtesy of Stainless Structural

## Why?

Since its inauguration in the early sixties, Seattle's Space Needle required restoration due to corrosion in metals used in the original structure.

## Needed Action

Stainless Steel and glass were chosen as best options for the observation deck of the structure in order to extend the life of the viewing area by avoiding corrosion associated with other metals used in the past. This will have the benefit of lowering maintenance costs over time.

## Action Review

**Specific;** replacement of metal wire cage with glass braced by stainless steel channels in T316L grade

**Measurable;** The cost savings due to lower maintenance will be measurable over life span

## Horizontal Expansion Capability

Similar design using glass and stainless steel can be expanded for use in other buildings and structures.

## Outcome

The new glass and stainless steel design increased viewing area by 35% and will reduce maintenance costs and extend life cycle of the structure.



## Nuaire Biological Safety Cabinets

**Member company  
Categories**

**North American Stainless  
reduction in routine maintenance  
costs; life-cycle costs lowest  
compared to competing materials**

### The Challenge

Provide an easy to clean rust free surface for cabinets used in the fields of virus research, vaccine development, therapeutics and diagnostic testing.

### Why?

Researchers required the use of a cabinet that would both offer a high degree of biological safety as well as a clean work area. The cabinet used had to be free of corrosion but at the same time had to be able to withstand harsh cleaning agents to ensure the safety of the researchers.



Picture courtesy of North American Stainless

### Needed Action

The use of stainless steel grade T304L was considered the ideal metal for the type of cabinet due to the advantages of corrosion resistance and the ability to keep working surfaces cleaner than if other materials were used.

### Action Review

**Measurable;** National Institute of Health specifications have to be met for product.

### Outcome

Global sales of stainless steel biological safety cabinets attest to the benefits found in a cabinet with stainless steel components.



## Outdoor Wood Burning Stove

**Member company Categories**

**North American Stainless original application concept for stainless steels; life-cycle costs lowest compared to competing materials**

### The Challenge

Solve the problems of rural housing having access to efficient heating for houses and other structures.

### Why?

There is a need to provide efficient heating for rural houses that do not have easy connection to utilities, the types of stoves used in the past had a short life span with iron and carbon steel parts corroding due to being outdoors.

### Needed Action

Use of stainless in grade T409 for the furnace so that corrosion is minimized and the unit has a much longer working life.



Picture courtesy of North American Stainless



Picture courtesy of North American Stainless



Picture courtesy of North American Stainless

### Horizontal Expansion Capability

Use of Stainless Steel Wood Burning Stoves can be expanded to most rural areas.

### Outcome

The popularity of these models show that they are fulfilling a need for rural communities.





## Stainless Steel Cable Strand

**Member company** North American Stainless  
**Categories** original application concept for stainless steels; life-cycle costs lowest compared to competing materials

### The Challenge

Reduce corrosion failure in prestressing steel in prestressed concrete

#### Stainless Steel Prestressed Concrete (PC) Strand for use in prestressed concrete construction

As the US infrastructure continues to age, many state departments of transportation (DOT's) as well as the Federal Highway Administration (FHWA) are beginning to demand longer-life structural designs which are defined as having a 75-year to 100-year service lives. In order to achieve these longer-life design requirements, several states and owners are beginning to specify more corrosion resistant reinforcing materials. High-strength stainless steel prestress strand (PC strand) and stainless steel rebar have ground with D.O.T's.

Prestressed concrete products are commonly used in infrastructure products such as bridge girders, bridge support, piles, bridge deck panels, etc. These structural elements can be subject to aggressive conditions such as deicing road salts in the winter months or chlorides from seawater exposure. These aggressive conditions can cause corrosion of mild reinforcing steel and premature failure of the structural concrete elements. Once mild steel corrosion initiates, the costs to repair and/or replace the compromised elements can be high, both in terms of the replacement costs as well as the user costs in the



Picture courtesy of North American Stainless

affected areas due to traffic disruptions during repairs. The use of stainless steel in critical infrastructure projects will ensure a reduction in maintenance costs and a significant increase in the service life of these structures.

In order to achieve the right combination of high-strength and corrosion resistance, duplex alloy 2205 was identified as the most suitable stainless steel material for making high-strength stainless steel PC strand. Stainless steel rebar has been widely available in the US market for several years, but stainless steel PC strand is a relatively new product offering. In fact, the first ASTM standard for high-strength stainless steel PC strand was developed in 2020, ASTM A1114.



Until recently there was no supplier of U.S. produced stainless steel PC strand. In order to supply the growing need, Sumiden Wire working closely with North American Stainless (NAS) developed and began production of high-strength stainless steel PC strand. With the development of its High strength stainless steel PC strand using duplex alloy 2205 melted and rolled by NAS, Sumiden is able to offer a product that is both ASTM approved and fulfills all of the “Buy America” requirements usually associated with federally-funded transportation infrastructure projects in the U.S.

## Why?

Need to reduce risk of corrosion induced failure of prestressed concrete segments on U.S. bridges.



Picture courtesy of North American Stainless



Picture courtesy of North American Stainless

## Needed Action

Develop U.S. domestic stainless steel cable strand in grade 2205 for supply of U.S. market.

## Action Review

**Specific;** education of U.S. D.O.T's on merits of stainless steel cable strand for prestressing application.

## Horizontal Expansion Capability

Replacement of carbon steel with stainless for this application can be expanded to any structure that has prestressed concrete.

## Outcome

The benefits will become apparent over time based on the reduction of maintenance costs in comparison with the use of carbon steel.



NIPPON STEEL Stainless Steel Corporation

## Adoption of Alloy-Saving Duplex Stainless Steel SUS821L1 (NSSC 2120) for Floorboards of the Food Factory

Member company	NIPPON STEEL Stainless Steel Corporation
Categories	preservation of scarce resources; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials

### The Challenge

NIPPON STEEL Stainless Steel's alloy-saving duplex stainless steel SUS821L1 (NSSC 2120) was adopted as the material for the floorboards of the food factory. Generally SUS304 with a thickness 4.0 mm is used for stainless steel floorboard. By using SUS821L1 the material was thinned to 3.0 mm because SUS821L1 has the same corrosion resistance as SUS304 and is even higher in strength despite its lower alloy content (21Cr-2Ni). It also contributed to improving the workability at the work site.

### Why?

Stainless steel used as a floor material is generally SUS304 with a thickness of 4.0 mm. There is a problem in workability at the work site due to its heavy weight.



Picture courtesy of NIPPON STEEL Stainless Steel Corporation

### Needed Action

The material for floorboards of food factories, in addition to being resistant to scratches, abrasion, cracks, dents, must be able to maintain cleanliness by suppressing the growth of bacteria and mold due to residual relics on uneven parts. In this case, the flatness was ensured by the original technology developed by the contractor. Furthermore to use duplex stainless steel, welding and other



construction techniques were optimized.

## Action Review

**Specific;** Achieved the adoption of duplex stainless steel for stainless steel flooring.

**Measurable;** In order to both secure the strength of the material and reduce the thickness and weight, SUS304 with thickness 4 mm is changed to duplex stainless steel SUS821L1 with thickness 3 mm.

**Achievable;** In order to apply duplex stainless steel, the construction technology was optimized.

**Realistic;** Duplex stainless steel is more likely to be applied as a material for building materials that require strength as in this case.

**Time-bound;** Within a limited schedule until the factory started operation, the material was selected and construction technology was optimized.

## Horizontal Expansion Capability

Thinning and weight reduction with high-strength duplex stainless steel can be achieved in other fields as well. Especially in Japan, the labor shortage is expected to become more serious due to the declining birth rate and aging population, and the need for improved workability is considered to be high.



Picture courtesy of NIPPON STEEL Stainless Steel Corporation

## Outcome

By thinning SUS304 with thickness 4 mm to SUS821L1 with thickness 3 mm, the amount of material used was reduced by about 25%. The contractor reported that the weight reduction of the board reduced the carrying-in work and the number of workers per hour by 20% or more.



NIPPON STEEL Stainless Steel Corporation

## Duplex Stainless Steel Plate SUS329J1(NSSC 2351) for Flux Tank of Zinc Coating Line

<b>Member company</b>	<b>NIPPON STEEL Stainless Steel Corporation</b>
<b>Categories</b>	<b>preservation of scarce resources; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials</b>

### The Challenge

In the Hot-Dip Galvanizing process, Flux Treatment with Zinc Chloride Ammonium Solution is necessary. The flux tank is in a very severe corrosive environment. In the past SUS316L was used, but it needed regular repairs and maintenance. SUS329J1(NSSC 2351) has higher corrosion resistance than SUS316L, and the maintenance frequency can be significantly reduced. In addition, it is stronger than SUS316L, making it possible to reduce the thickness and weight of the tank and at the same time improve seismic performance.

### Why?

As Zinc Chloride Ammonium Solution at temperature ranging from 50 to 80° C is used in the Flux Treatment, in case SUS316L is used again, replacement of the tank will be necessary after same period of the time passed.

By using SUS329J1 which has higher corrosion resistance, higher strength, and stress corrosion cracking resistance than SUS316L, it is possible to extend the life time of the Flux Tank and improve seismic performance as well as LCC.



Picture courtesy of NIPPON STEEL Stainless Steel Corporation

### Needed Action

By using a wide thick plate (3m x 14m) as the base material of the Flux Tank body and H-shaped Steel made of SUS329J1 as the reinforcing material, the numbers of welding portion and welding distortion has been reduced and construction period were shortened. In addition to providing materials, we also proposed solutions that included processing and construction.



## Action Review

**Specific;** Reviewing the design of the Flux Tank and examining the possibility of reducing weld points.

**Measurable;** Providing Wide Plates to reduce weld points

**Achievable;** Improving weldability which used to be a weak point of Duplex Stainless Steel from the material level

**Realistic;** By Reducing weld points, tank thickness, weight and improved on-site workability, realized the first order for Steel Manufacturing Equipment

**Time-bound;** We proposed and provided materials in time for the renewal of the Flux Tank.

## Horizontal Expansion Capability

In the future, it will be developed horizontally in steel-related equipment and as an applicable material in other fields.

There are fields where SUS316L is used in environments with severe corrosion resistance, such as the food industry, infrastructure equipment and shipbuilding all of which are expected to have long life due to high corrosion resistance. In addition, thin thickness with lighter weight due to high strength is expected. The potential market is relatively big.

## Outcome

- **Cost reduction** (Material cost + Lighter weight with thinner thickness)
- Extend Flux Tank life time
- Promotion of SUS329J1 to similar applications
- NSSC 2351(SUS329J1) was adopted for the first time in steel-related equipment, and it was possible to increase the options for users who are considering renewal of the similar equipment.



NIPPON STEEL Stainless Steel Corporation

## Adoption of SUS821L1 for Sumida River Terrace Bridges (include Tsukishima River & Oshima River)

Member company	NIPPON STEEL Stainless Steel Corporation
Categories	preservation of scarce resources; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials

### The Challenge

The Tokyo Metropolitan Government is carrying forward Sumida River Terrace continuity project as part of living environment improvement for residents. In the past, Carbon Steel Structural Steel has been used for this bridge, but due to the severe corrosive environment of brackish water. After rusting, it required regular painting maintenance.

This time, in response to requests from project consultants and business owners, we proposed high-strength and high-corrosion-resistant SUS821L1 (JIS certified) to reduce material thickness and painting maintenance cost. As a result, it contributed the total project cost saving.

The nearby both Tsukishima River and Oshima River Water Gate Terrace Connecting Bridges are the first bridges in Japan using stainless steel for the main structures, which match the surrounding environment and facilitate on-site workability.

In the future, based on this result, we would like to appeal to the renovation work of aging domestic bridges and lead to promote the Duplex Stainless Steel in the infrastructure field.



Picture courtesy of Road Structure Journal

### Why?

The Sumida River is a large-scale river that flows through central Tokyo. However, residential areas are densely packed around the project site of the bridges and it is particularly difficult to take the time of repainting works in the future. Therefore there was a strong request for maintenance-free bridges made of Stainless Steel.



Picture courtesy of NIPPON STEEL Stainless Steel Corporation

## Needed Action

Prior to this Sumida River Terrace Bridges, there have been no cases in Japan for which Stainless Steel was used for the main structures of bridge facilities. Therefore, the Japanese Society of Steel Construction (JSSC) played a major role in setting standards for applying Stainless Steel to structures, as well as appealing to business owners and designers the excellent aesthetics, corrosion resistance and environmental friendliness of Stainless Steel bridges. We have developed steady approaches to eliminate concerns such as weldability.

## Action Review

**Specific;** The first bridges in Japan using Stainless Steel for the main structures.

**Measurable;** Creation of design standards for Stainless Steel bridges, appeal to design consultants and business owners, execution of exposure tests in the natural environment and summarize the results to the report.

**Achievable;** A consultant requested cooperation for the Sumida River Terrace Bridges project, and carrying out the work of proposing Stainless Steel in accordance with it led to the achievement of the goal.

**Realistic;** Stainless Steel structures have many achievements in dams and gate equipment. By showing that the adoption of Stainless Steel is the most advantageous in terms of total cost, and it was possible to deploy it to bridges.

**Time-bound;** We showed the superiority of Stainless Steel before the basic design of the project has been completed.

## Horizontal Expansion Capability

In total, 6 bridges are planned for the Sumida River Terrace Bridges, including the 2 bridges this time, and construction of the other 4 bridges is yet to be completed, but the basic design is progressing with Duplex Stainless Steel and it is expected to be ordered soon.

In addition, duplex stainless steel inspection roads (smart inspection roads) that apply this bridge technology have begun to be adopted for inspection roads that are obliged to be installed on viaducts. Furthermore, there are several cases of adoption in inspection bridges for entering and exiting river facilities managed by the government, and they are becoming nationwide spread.





## Outcome

**business efficiency benefits;** It has been adopted in public properties, and there is a movement to build a new supply chain with stock in the market, aiming for quick delivery. In addition to Stainless Steel Sheets, the need for round bars for bolt manufacturing has increased. The ripple effect to Long Products has also begun.

**cost benefits;** It leads to cost reduction by mass production effect of SUS821L1 and shortening of delivery time by building supply chain. Increased convenience and benefits from the user's perspective.

**material quality benefits;** The quality level required for the bridge was clarified, and we could satisfied it.

**inventory levels and sales (KPIs) benefits;** This is Japan's first demonstration project for Duplex Stainless Steel in the bridge field, and it has paved a way for using this material in infrastructure development projects in urban areas.



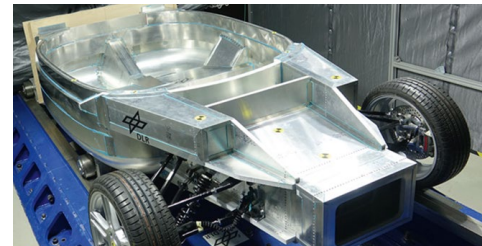
## Foam-filled Stainless Ring Structure for DLR Next Generation Car

**Member company  
Manufacturer**

**Outokumpu  
Deutsches Zentrum für Luft- und  
Raumfahrt e.V. - Institut für  
Fahrzeugkonzepte (DLR, German  
Aerospace Center)**

**Categories**

**original application concept for  
stainless steels; promotes a bespoke  
or non-standard grade; strong  
environmental potential;  
preservation of scarce resources;  
life-cycle costs lowest compared to  
competing materials**



Pictures courtesy of the German Aerospace Center (DLR).

### The Challenge

Twenty institutes of the German Aerospace Center (DLR) rised to the challenge of developing new vehicle concepts with their "Next generation Car" large scale project which develops solutions for the upcoming challenges of sustainability, zero emission and cost-efficiency without decreasing lightweight and safety expectations. For the area of regional transport, DLR developed the "Safe Light Regional Vehicle" (SLRV) having its Roll-out in October 2020. The vehicle offers zero emissions as it is powered with a highly efficient hybrid fuel-cell-battery drive-train resulting in a driving distance > 400 km. The car body structure is designed as an ultimate lightweight structure resulting in a weight of just 90 kg without doors but having the highest possible passive safety.

The reason behind the outstanding combination of lightweight and safety is an innovative sandwich construction. An essential component of this car body is a circumferential ring structure filled with foam. For the ring structure, Outokumpu's new ultra-high strength stainless steel Forta H500 was used, offering an initial yield strength > 530 MPa with an elongation of > 50% at the same time. Because of its specific TWIP hardening mechanism, the material reacts perfectly during impact situations with a significant strain hardening and highest possible energy absorption. As a fully austenitic material it is alloyed without Nickel and therefore price stable for automotive series applications. The total vehicle price is expected to be approx. 15,000 € which results for a usage life of 10 years with 300,000 driving km in a related price of 10 cent per km.



## Why?

Megatrends like urbanization (including quiet traffic), new mobility services (car sharing, commuter support) and environmental compatibility combined with the question of a safe and affordable mobility already starts affecting personal's life and the whole processing industry in the automotive supply chain. New solutions need to be developed which can solve the challenging contrasts of lightweight, safety, cost-efficiency and sustainability. New materials like ultra-high strength stainless steels could offer a significant support to solve those challenges.

## Needed Action

- DLR designed a completely new vehicle structure using an innovative sandwich construction with a circumferential ring structure where ultra-high strength stainless steel is filled with foam
- The vehicle structure is combined with a highly efficient and quiet hybrid fuel cell – battery engine including a fuel cell system (8kW), a hybrid battery (25kW), a hydrogen high pressure tank and two synchronous motors
- Outokumpu delivered its new ultra-high strength stainless steel Forta H500 to fulfil the needed challenging requirements in point of lightweight, safety, sustainability and processing
- DLR manufactured the complete vehicle with its roll out on October 2020
- Extensive laboratory tests including crash tests related to US-NCAP standards
- Extensive test drives to determine and improve driving behaviour and driving distance

## Action Review

### Specific and measurable:

Clear and detailed targets for all development areas like driving distance (>400 km), weight of the structure (< 100 kg), total vehicle weight (< 450 kg), emissions (zero), lifetime costs (10 years of usage with 300,000 km driving

distance and purchase price for the vehicle of 15,000 €), crash-test results (zero mm intrusion into passenger compartment)

### Achievable; Realistic and time-bound:

Large-scale project was scheduled to have its successful roll-out on 2020-10-01 with its first test drive, all development targets solved successful in time

## Horizontal Expansion Capability

The developed sandwich stainless steel ring structure can be also used in future for other passenger vehicle types. In fact, it can be also derived to other applications in mobility and transport like any kind of commercial vehicles to protect passengers (buses) or goods. The design approach can be also used to protect stationary goods.

In general, the integrated new technologies in the project offers new application opportunities for stainless steels as the material could be also applied for the bipolar plates of the fuel cell system, the pressure tank or as part of the electric engine.

## Outcome

- Driving distance of 400 km
- Low and scalable manufacturing costs also for low and medium-sized quantities (15,000 € purchasing price per vehicle resulting in 10 cent per kilometre mobility costs)
- Lowest possible weight of the structure: 90 kg (because of the stainless-foam sandwich ring structure design)
- Fulfilment of crash test: zero mm intrusion into passenger compartment
- Zero emission vehicle



## New Pooley Bridge

<b>Member company</b>	<b>Outokumpu</b>
<b>Manufacturer</b>	<b>Knight Architects</b>
<b>Categories</b>	<b>original application concept for stainless steel; promotes a bespoke or non-standard grade; significant global market potential; strong environmental improvement potential; GHG emissions reduction; preservation of scarce resources; reduction in routine maintenance costs; life-cycle costs lowest compared to competing materials</b>

### The Challenge

There exists a huge market potential to increase the use of stainless steel in bridge building. With a few limited exceptions use of stainless steel has so far been mainly limited to use in fabricated pedestrian bridges, use of rebar in concrete bridges and use in a very few examples of rail bridge structures. Road bridges commonly use a combination of a steel structure acting compositely with a concrete deck and is a large sub-set of the global bridges market where stainless steel has almost no penetration today. The challenge is to encourage bridge designers to holistically consider the advantages of stainless steel over carbon steel with this type of bridge. The construction industry is conservative,



Picture courtesy of Knight Architects

and bridge owners tend to focus on initial construction cost, so there is a particular challenge to minimise initial costs with stainless steel, and to establish that the long-term advantages of stainless steel will outweigh any increase in initial costs. A bridge design team also needs to convince the end-client who will purchase the bridge that stainless steel is the optimum solution.



## Why?

The challenge was to fully complete a composite bridge project in stainless steel. Only by completing such projects can the full range of detailed challenges and their solutions be demonstrated. This means working through the whole bridge building process from concept design, acceptance of stainless steel material & bridge design proposal, fabrication, erection and finally the opening ceremony. Successful projects can then be used as case studies to encourage wider adoption of stainless steel in other similar projects around the world.

## Needed Action

The first action was to engage with many bridge design houses to promote the concept of using stainless steel in bridges, and gain a buy-in to the proposal to consider stainless steel for road bridges. Upcoming potential projects where stainless steel might be considered were discussed and impact on LCC and LCA discussed. The range of duplex stainless steels available were discussed, and how specific grades can be used based on the bridge location and the local environmental conditions. The high strength and lower cost of the lean duplex grades was promoted. When a bridge project was proposed, the design team was supported throughout the project with technical information over grade selection, design properties, welding & fabrication and surface finishes.

## Action Review

**Specific;** Specific technical & costing information was given to enable a bridge to be turned from concept to reality

**Measurable;** Several discussions were held during the course of the project at which high quality technical information was provided to the design team.

**Achievable;** The bridge was built

**Realistic;** The bridge was built

**Time-bound;** Contact with the design team was over about 4 years from pre-concept design to opening of the bridge

## Horizontal Expansion Capability

There is a huge potential around the world to expand the use of stainless steel into road bridges. Every new bridge designed using structural stainless steel will increase use of stainless steel at the expense of carbon steel. This project can be used as a successful example. Not only the bridge itself, but the engineering companies involved with the design and construction and the bridge owner have had a positive experience working on the project and have themselves become ambassadors for a bridge solution involving stainless steel.

## Outcome

The immediate benefit has been a sale of 104 tonnes of LDX2101 quarto plate to the project.

However, there has been a much wider benefit to the image of stainless steel in this sector. Both Chalmers University and The Institution of Civil Engineers have separately organised seminars about the Pooley Bridge project (held as webinars due to Covid-19 situation), with hundreds of bridge engineers from outside the regular world of stainless steel hearing about a successful application of duplex stainless steel. Positive articles are regularly featuring in the construction industry trade press, for example two detailed articles have been written for New Civil Engineer. An article on the bridge featured in UK national newspaper The Guardian, and the bridge has featured on TV news bulletins. The bridge design team is giving conference papers and talks at bridge & construction industry events. Social media channels have been very active with praise for the bridge. Use of high strength duplex stainless steel minimised the weight of steel used and also allowed the bridge to be built using less concrete. This gives an



environmental benefit through reduction in the use of earth's resources and lower carbon footprint. The bridge replaced an earlier stone bridge that was severely damaged & swept away by flooding in a storm. The new bridge design allows flood water to pass through more easily, and the use of stainless steel means the structure is more resilient to minor damage from debris in any future storm water. The local authority owners of the bridge are welcoming the anticipated lower maintenance costs in future. The overall appearance of the bridge is very slender and elegant, especially for a road bridge, a tribute both to the designer and the high strength duplex material used. It has been a notable discussion point that the local community wanted a bridge that was simultaneously "modern" and "traditional" and one that should not be ostentatious. The resulting bridge is widely acknowledged to meet these demands, with stainless steel as a material contributing significantly to these wishes.

The project is the first use of structural lean duplex grade LDX2101 in any bridge in the UK, and is the first road bridge in the UK to use any type stainless steel in the main structure. To our knowledge, it is the most significant example of LDX2101 stainless steel used in a composite concrete road bridge to date in the world.

The bridge was completed and opened to road traffic in autumn 2020, and has been very well received by the local community. At time of writing His Royal Highness, Prince of Wales (British royal family & heir to the throne) has been invited by the local authority to formally inaugurate the bridge.



Picture courtesy of Knight Architects

CLIENT: Cumbria County Council  
ARCHITECT: Knight Architects  
CONCEPT STRUCTURAL ENGINEER: Mott MacDonald  
CONTRACTOR: Eric Wright  
CONTRACTOR STRUCTURAL ENGINEER: GHD  
FABRICATORS: DNA Metalwork, WEC Ltd.  
MATERIAL: Outokumpu LDX2101



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## About ISSF

The International Stainless Steel Forum (ISSF) is a not-for-profit research and development organisation which was founded in 1996 and serves as the focal point for the global stainless steel industry.

### Vision

Sustain our future with stainless steels

### Membership of the ISSF

ISSF has two categories of membership namely:

- a. [company members](#) who are producers of stainless steels (integrated mills and re-rollers)
- b. [affiliated members](#) who are national or regional stainless steels industry associations.

The ISSF now has 57 members in 26 countries.

Collectively they represent approximately 90% of the total production of stainless steels.

### More information

For more information about ISSF, please consult our website [worldstainless.org](http://worldstainless.org).

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