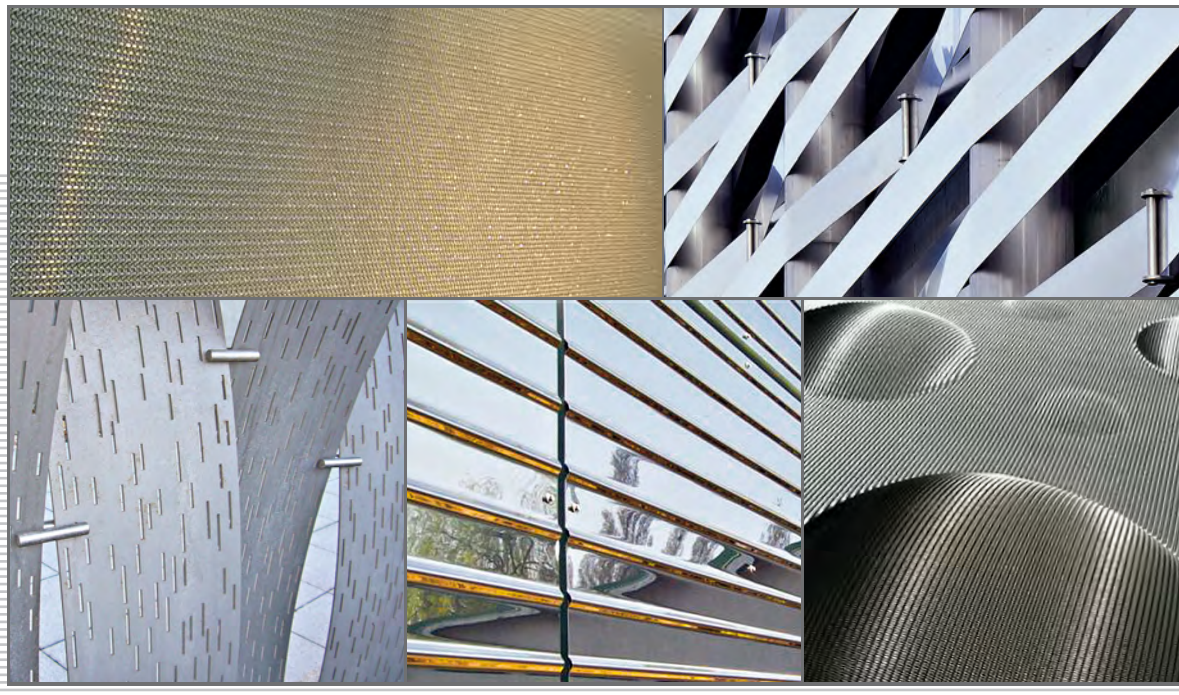
euro inox
The European Stainless Steel Development Association

Depth, Pattern and Texture – The Third Dimension in Stainless Steel Surfaces



Building Series, Vol. 14

Euro Inox

Euro Inox is the European market development association for stainless steel.
The members of Euro Inox include:

- European stainless steel producers
- National stainless steel development associations
- Development associations of the alloying element industries.

A prime objective of Euro Inox is to create awareness of the unique properties of stainless steels and to further their use in existing applications and in new markets. To assist this purpose, Euro Inox organises conferences and seminars, and issues guidance in printed form and electronic format, to enable architects, designers, specifiers, fabricators, and end users to become more familiar with the material. Euro Inox also supports technical and market research.

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Content

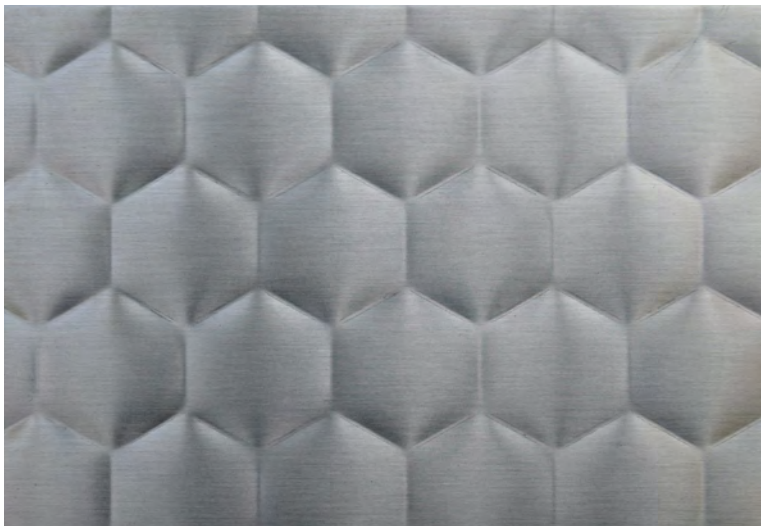
Introduction

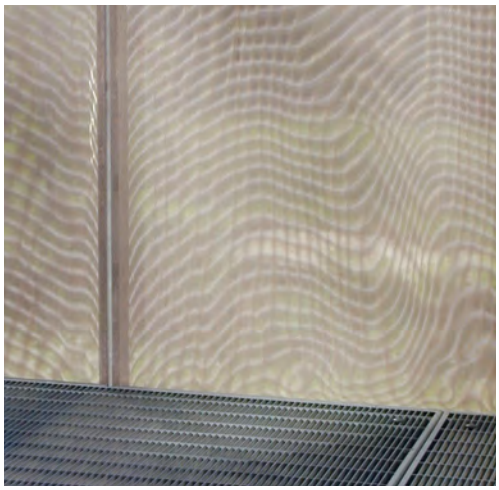
When choosing a material, architects are increasingly looking not only at functional performance but also at less quantifiable characteristics, such as aesthetic effect, colour and texture, all of which have an important effect on the final result. This goes hand in hand with advances in manufacturing processes which are opening up new possibilities. Architects, engineers and designers are taking up the challenge and exploiting this creative potential with exciting results.

The first brochure in the Building Series, entitled 'Guide to Stainless Steel Finishes', set out the mill finishes and special surface treatments, for example mechanical polishing, brushing, bead-blasting and textured rolling, that can be applied to give interest to a flat surface. DIN EN 10088-2 covers the mostly single-sided treatment of surfaces in stainless steel sheet. In this present brochure we turn to three-dimensional surface structures and how they are created and semi-finished products made mainly from fine sheet or wire.

These structures are formed by using techniques such as embossing, punching, cutting, profiling and weaving, carried out on computer-controlled machines to generate a wide variety of patterns and structures. And, by combining different techniques, new areas of application are opened up. The many examples in this brochures show not only outstanding use of the unique properties and qualities of the material stainless steel, but also the surprising and unusual results in terms of transparency, light and shade, new shapes and surface effects that can be achieved by moving into a third dimension.

A bionic technology, which has become known as vault structuring, creates honeycomb-shaped three-dimensional buckling, offset in multiple dimensions. This new method is particularly gentle on the material and the surfaces. High rigidity combined with low weight is a significant advantage, along with a reduction in glare due to the diffuse light-scattering effect of the surface.





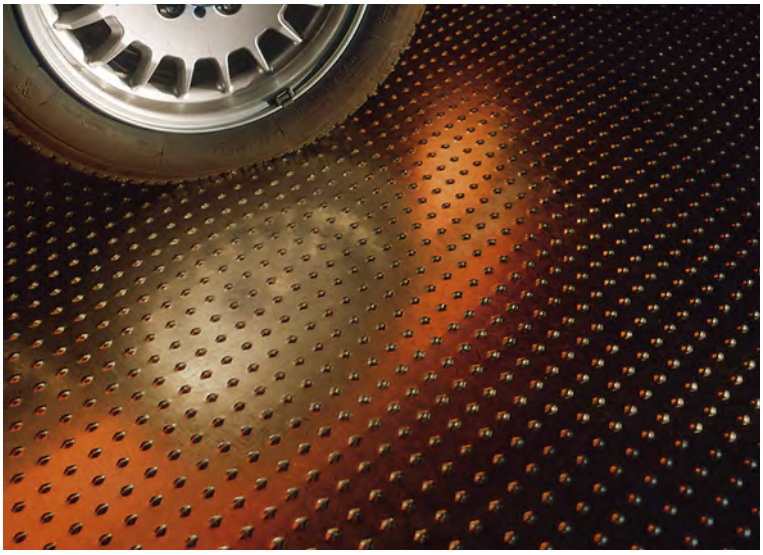
Originally developed for industrial filters, woven wire mesh of stainless steel is finding increasing application in architecture today. This double layer of fine mesh made from just 0.2 mm wire is used here as balcony railings on an apartment block in Berlin.

Photos: Wolfram Popp Planungen, Berlin (right); Dr. Mirtsch GmbH, Teltow/ Martina Helzel (left)

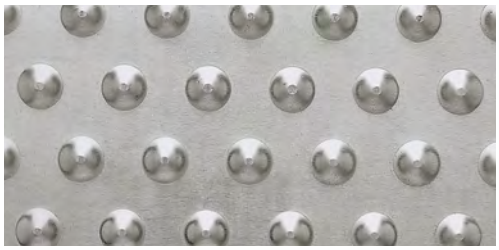
Embossed Sheet

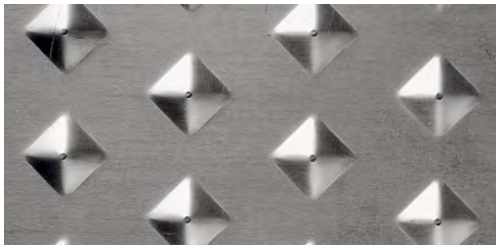
Industrially manufactured embossed sheet has a regular, raised geometric pattern with either a smooth, brushed, matt or shiny surface. It is made by taking a stainless steel panel or sheet from the coil and pressing it between two moulds or matrices. The thickness of the sheet remains unchanged. The process of impressing the design gives rise to two different sides, one with a raised pattern and one with indentations: the side with the raised pattern is usually the one that is displayed.

The forces involved during the process of impressing the design would normally lead to the sheet deforming slightly. In order to maintain the flat visual plane, it is fixed in special rolling machines. The manufacturers offer a range of embossed patterns, achieved by employing different tools. There are flat, round, semi-round and square indentations, diamonds or pyramids, plus many special forms. For individual commissions, advances in CNC controls are exploited to produce custom random designs. In this way, even smaller quantities become viable.



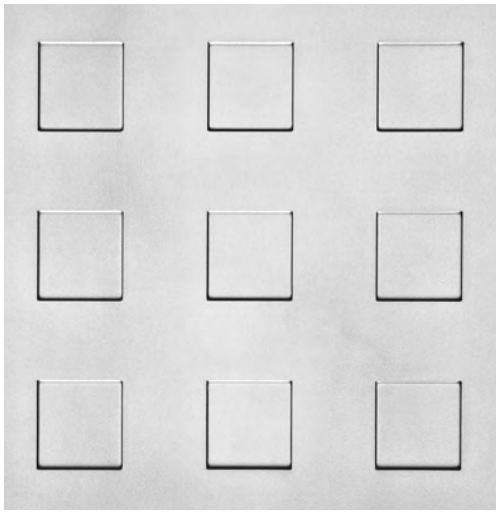
Embossed stainless steel with its high-quality looks and industrial feel was used as flooring in this car showroom.





The four examples show a selection of the many designs that are available.

Photos: Moradelli, Kirchheim near Munich



The parapet panels on the Sony Centre at Potsdamer Platz, Berlin, have a slightly raised square pattern.

Juxtaposed against the glass, the high surface flatness of the embossed panels becomes evident.

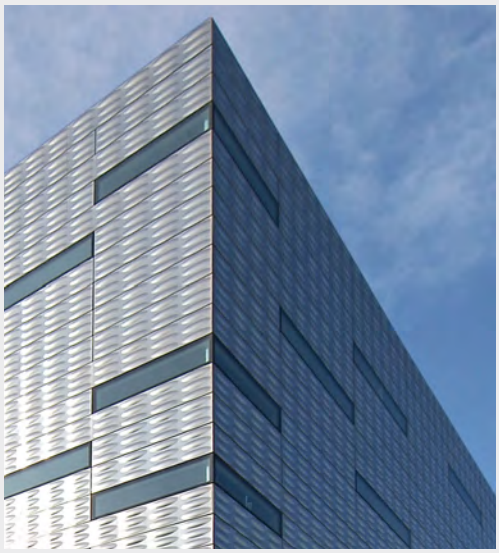
As well as being attractive to look at, patterned sheet also makes good anti-slip flooring.

Photos: Fiedler, Regensburg (top left); Martina Helzel, Munich (top right); MN Metallwarenfabrik, Neustadt (bottom)

Ice-Hockey Stadium in Turin, Italy

Client:
Agenzia Torino 2006
Architects:
Arata Isozaki & Associates, Tokyo
with Pier Paolo Maggiora
Structural engineers:
Arup, Milan

Longevity was a factor in the concept behind this ice-hockey stadium. This is reflected in the material used in the façades and in the plans to use the building for exhibitions and concerts at a later date.



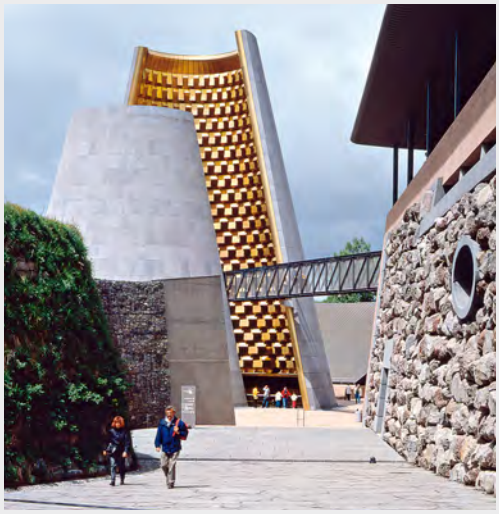
This site, once used for the football world championships in 1934, was redesigned for the Winter Olympics in 2006. A new ice-hockey stadium sets up an interesting contrast to the old concrete stadium opposite. It features a cube clad with stainless steel panels sitting on top of a glazed ground-floor level. The long rectangular panels decorated with a raised linear pattern are aligned horizontally, thus emphasising the lines of the clearly structured box.

Photos: Claudio Agnese/Agenzia Torino 2006, Turin (top, centre);
Fondazione Promozione Acciaio/D. Badolato, Milan (bottom)

The embossed 1.2 mm panels of stainless steel (grade: EN 1.4404) with a brushed finish are 5400 x 500 mm in size. Flush-fitting windows in a corresponding format lend added dynamism to the façade.

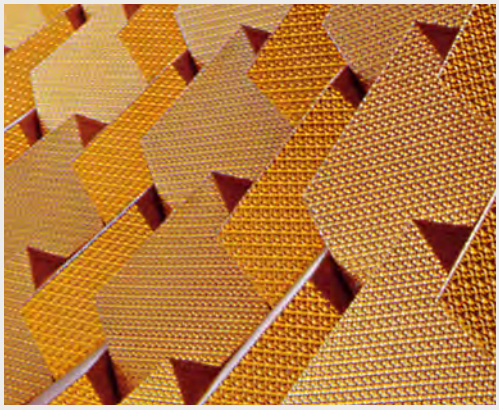
Volcano Museum in Saint-Ours-Les-Roches, France

Client:
Conseil Régional d'Auvergne, Chamalières
Architect:
Hans Hollein, Vienna,
Atelier 4, Clermont-Ferrand/Issoire
Structural engineers:
BET ITC, Clermont-Ferrand



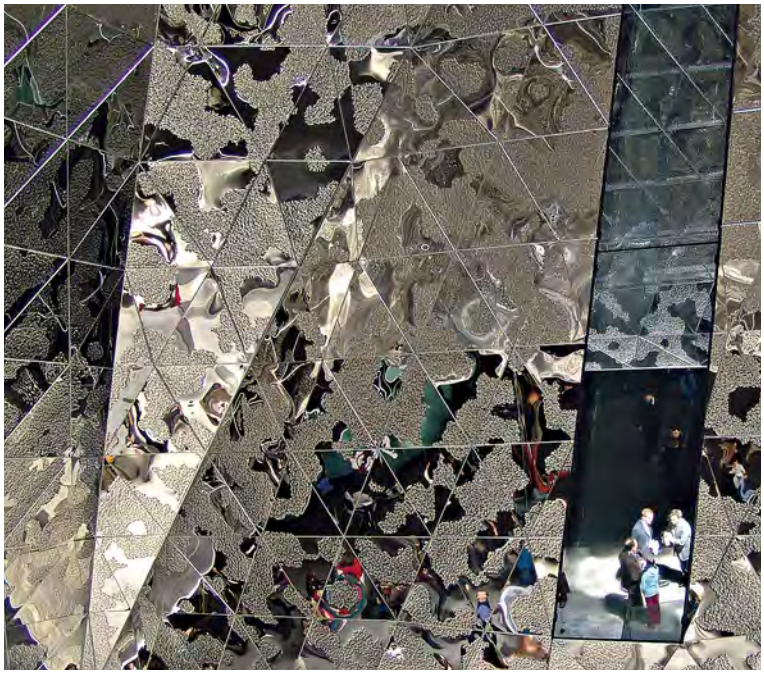
This unusual museum is located at an altitude of 1,000 m on the Puy-de-Dôme, a region of extinct volcanoes. In form and content the building seeks to present the subject of volcanism in an informative and lively way. The exhibition rooms are mostly underground, reached via a long ramp that leads down into a metaphorical magma chamber. The cone, clad on the interior with embossed (5 mm raised design) stainless steel sheet (grade: EN 1.4401), symbolises the glow of the molten rock inside the volcano; the colour is achieved by coating the steel with titanium nitride in a vapour-deposition process.

Photos: Atelier Hollein/Sina Baniahmad, Vienna

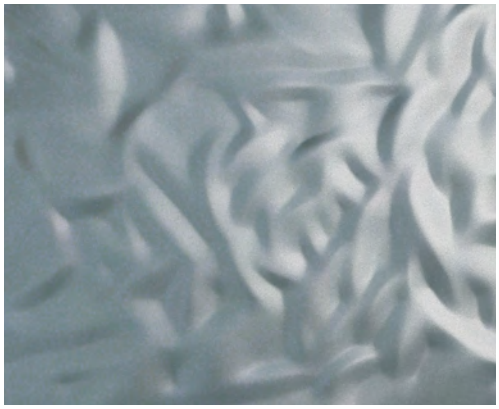


The embossed 1.5 mm thick stainless steel sheets were bent and fixed to the inside of the cone. A coating of titanium nitride produces the gold finish.

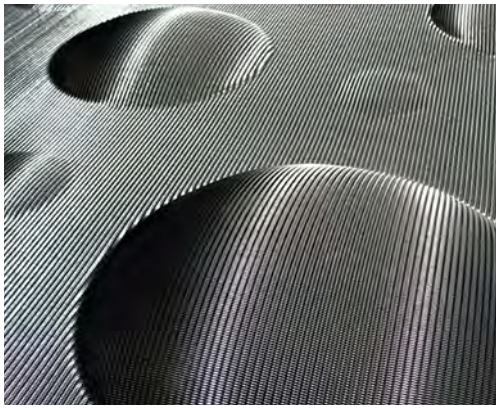
Customised patterns can be applied to individual sheets, using special control programs for the processing machines. When put together the differently patterned panels create an overall design or image, extending if required across the entire building envelope.

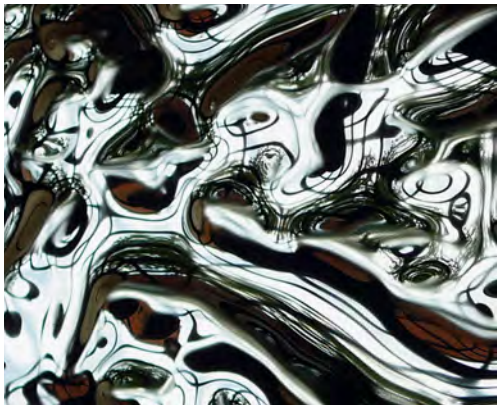


Over 28,000 differently patterned triangular panels were used on the Edificio Forum in Barcelona. The design, which is based on a real image, was embossed in the stainless steel sheets by computer-controlled machine.



A new technique of deep drawing (fluid forming) extends the design possibilities with formed sheet and woven metal in architecture and design. It is possible to process large components up to 4 m² in size and a material thickness of up to 3 mm.

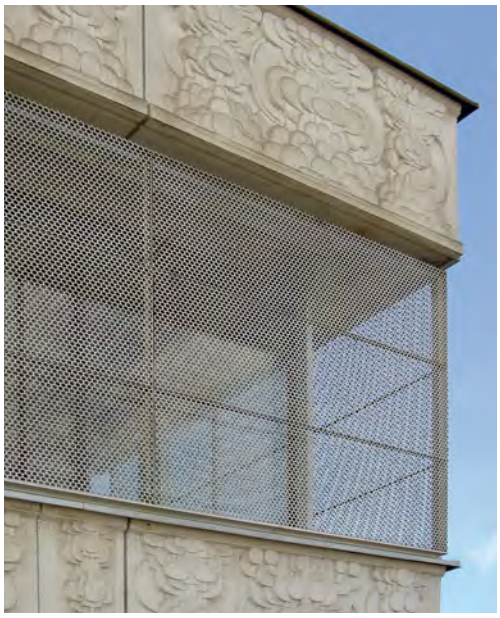




Photos: INOX-COLOR GmbH & Co. KG, Walldürn (top); Fielitz GmbH, Ingolstadt (centre, bottom)

Perforated Sheet

In refurbishing the railway station at Leoben, the old louvres in front of the windows were replaced with perforated stainless steel sheet (grade: EN 1.4301). The sheets, 1.5 mm thick and perforated with 25 mm dia. holes, fulfil their screening function, while also affording a high level of transparency.



Punching is the most cost-effective way of producing perforated sheet. In industrial manufacturing either individual metal sheets are processed or strips straight from the coil. The press punches individual holes or rows of holes in the sheets of stainless steel, with the punching motion always being in one direction, and perpendicular to the plane of the sheet. The energy introduced during perforation leads to tension in the sheet that has to be eliminated afterwards in a levelling machine.

The type of perforated sheet is determined by the thickness of the material, the shape, dimension and the arrangement of the holes, the width of material between the holes and the percentage of open area. The perforations – round, square, slotted, or one of many different special or decorative styles – can be applied in straight, diagonal or offset lines. Perforated sheet is suitable for a wide range of applications, for example in stand design and interiors, on façades, as solar-shading panels or balustrades and balcony parapets. Generally the diameter of the individual perforation should not be smaller than the thickness of the sheet. Continuing progress in computer-controlled manufacturing, in particular the use of CNC punching machines, gives tremendous flexibility when it comes to implementing customer-specific designs.

The proportion of perforations to overall surface area is of significance not only for air movement, but also for the structural strength of the component.

In this balustrade system in stainless steel the perforated sheets are finished with edging profiles.

Photos:
Graepel SA, Sabbioneta (top, bottom left);
MEVACO, Schlierbach (bottom right)

Danish Embassy in Berlin, Germany

Client:
Danish Ministry of Foreign Affairs, Copenhagen
Architects:
3XNielsen, Århus
Structural engineers:
IGH, Berlin

The Danish Embassy in Berlin, part of a compound of Scandinavian embassies, consists of two building volumes linked together. The wood and copper clad part traces the outer line of the complex, while the other part, a glazed entrance building clad with perforated stainless steel panels, is oriented towards the central courtyard.
Fitted in front of the glass façade are 1.5 mm stainless steel panels finished with a pattern of offset, slotted perforations (5/20 mm). All the panels can be opened upwards and outwards to regulate lighting levels. The stainless steel cladding continues on the interior wall of the covered atrium, contrasting intriguingly with the façade of wood slats opposite.

Photos: MEVACO, Schlierbach

Clear structures, light and the combination of wood and stainless steel give a pleasant, Scandinavian feel to the atrium of the Danish Embassy.

Panels of perforated stainless steel screen the interior from the sun. To give even more control over lighting levels, panels can be raised individually.

The new seating made of stainless steel and teak curves around the broad arc of this historic theatre.

Roman theatre in Fréjus, France

Client:
Ville de Fréjus
Architect:
Jérôme Cano, Hyères

New life was injected into the ancient theatre in the southern French town of Fréjus after new seating made of perforated stainless steel sheet and teak was installed. These modern fittings protect the historic structure from the large numbers of visitors and emphasise the archaic effect of the Roman site. The seating rows are of 3 mm stainless steel sheet with offset round perforations. Smaller round perforations are used for the treads of the steps, as a way of reducing the risk of slipping. Here in this coastal location stainless steel (grade: EN 1.4571) is able to resist the corrosive action of the salty air, and therefore keep the complex looking attractive for many years.

Perforated stainless steel sheet lends a light, airy look to the built-in units. The punched design on the treads of the steps also helps minimise the risk of slipping.

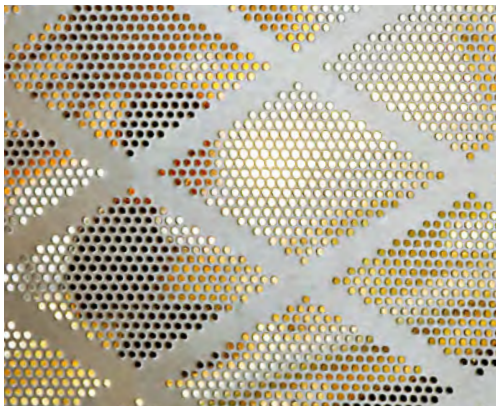
Photos:
MEVACO, Schlierbach

For designs that go beyond the technical capabilities of standard punching, for example for smaller perforations or large material thicknesses, it is possible to drill or mill holes and slits in the material. Modern computer-controlled machines with their three-dimensional strip-feed configuration are not restricted to round holes. Almost any size and shape of cut is possible, even conical.

The tourist information office in Tours, France, designed by Jean Nouvel, is fitted with a suspended ceiling system featuring stainless steel panels. The perforated panels act as an acoustic absorber.

For the 'sky bar' of a shopping centre in Manchester, England, the artist Mel Chantrey designed a special diamond pattern.

Modern punching techniques and flexibly controlled tools can be used to create individual perforated designs in series production.



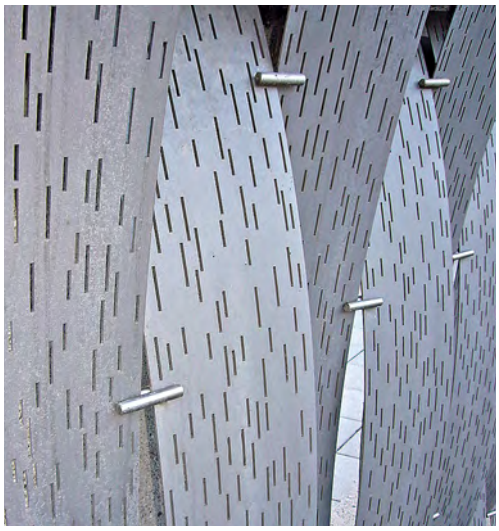
Photos: Tolartois, Béthune (top); MEVACO, Schlierbach (bottom left, bottom right)

Thicker stainless steel sheet can be processed using laser, plasma or water-jet cutters. For construction applications, lasers are generally used for cutting, for reasons of cost. The technique is fast, generates low heat and achieves clean cut edges. Depending on the system, it is possible to process stainless steel panels up to 20 mm thick.

This veil of ornamental, laser-cut 12 mm stainless steel panels overlays the different parts of the Ministry of Culture building in Paris.

Floral designs, laser-cut out of 5 mm stainless steel panels, cover the 3 m high ground floor of this administration building in Reutlingen.

Photos: Georges Fessy, Paris (top); Florian Holzherr, Munich (centre); Cordula Rau, Munich (bottom)

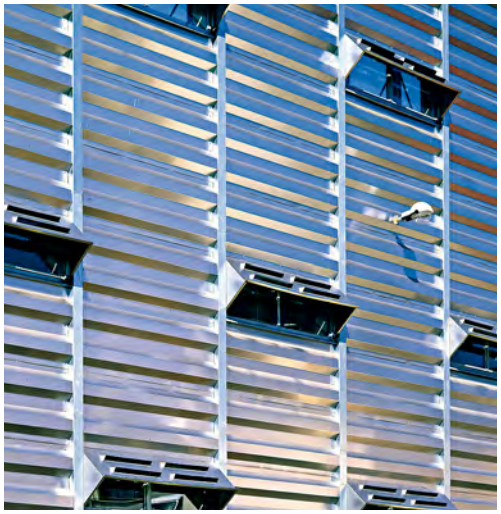


Curving stainless steel panels with a pattern of irregular, laser-cut slots provide light-permeable visual screening in front of a police station on Vienna's Karlsplatz.

Profiled Sheet

Linear profiling is achieved by running stainless steel sheets direct from the coil over forming rollers, sometimes as many as 20 rollers in succession. At each station the sheet is bent a little further, until the desired profile is reached. Then the material is cut into sections. This process is suitable for cost-effective manufacturing of large quantities, however the choice of profile styles is limited.

There is greater design scope in horizontal profiling of sheet. Individual panels, rarely whole coils, are drawn over a die, while another tool presses from above. By controlling the feed, irregular-shaped profiles can also be manufactured.



The distinctive profiles on the façade of this workshop building in the French town of Nogent-en-Bassigny echo the style of the silos in the surrounding countryside.

A wide variety of profile styles can be achieved by controlling the feed in the manufacture of horizontally profiled sheets.

The gleaming façade of the new fire service college in Paris owes its visual structure to horizontal ribs (20 mm wide x 10 mm high) at 100 mm spacing. (Grade: EN 1.4306; 2R finish).

Photos: Michel Denancé, Paris (top); Tolartois, Béthune (centre); Fielitz GmbH, Ingolstadt (bottom)

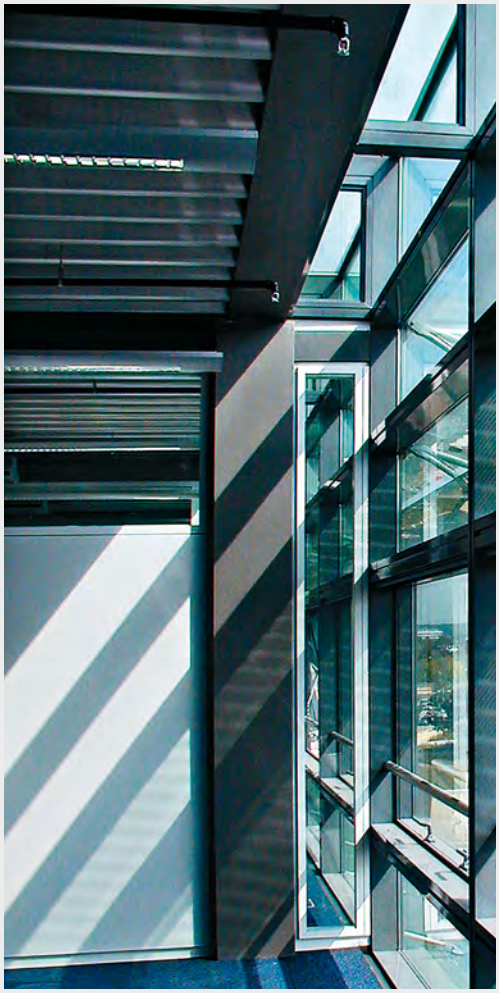
Chamber of Trade of Luxembourg, Grand Duchy of Luxembourg

Client:
Chambre de Commerce du Grand Duché de Luxembourg
Architect:
Claude Vasconi, Paris

New avenues in steel construction were explored in this chamber of trade building. Using a new method of calculation, it was possible to dispense with cladding for the steel components and still conform to the fire regulations. Also exposed is the profiled stainless steel sheet which served as mould when concreting the floors but now creates an attractive ceiling.

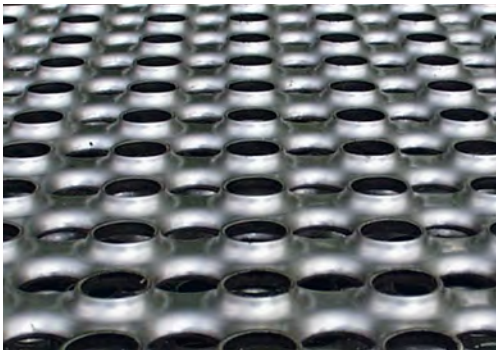
Photos: Claude Vasconi, Paris

The profiled stainless steel sheet which was used as formwork during the construction of the concrete floors remains on view as a ceiling.

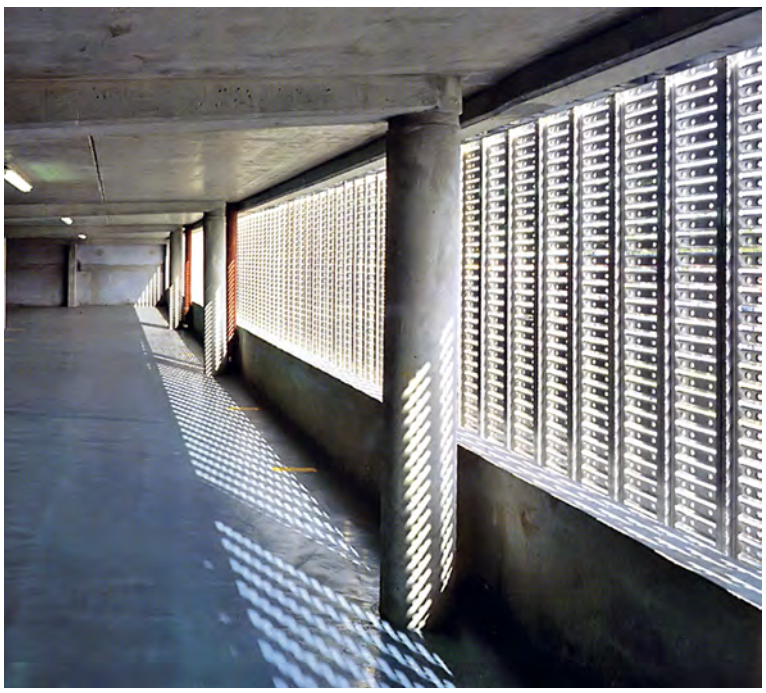


Cabling for the ventilation and sprinkler systems and for the lighting is concealed inside the cooling elements suspended from the ceiling.

Combined Techniques



Raised perforations are holes with raised, cone-like edges. When bent or ribbed, stainless steel sheet perforated in this way gains additional stability. Often raised perforations are used for anti-slip treads, but also as a robust solution for sunscreens or façade cladding.

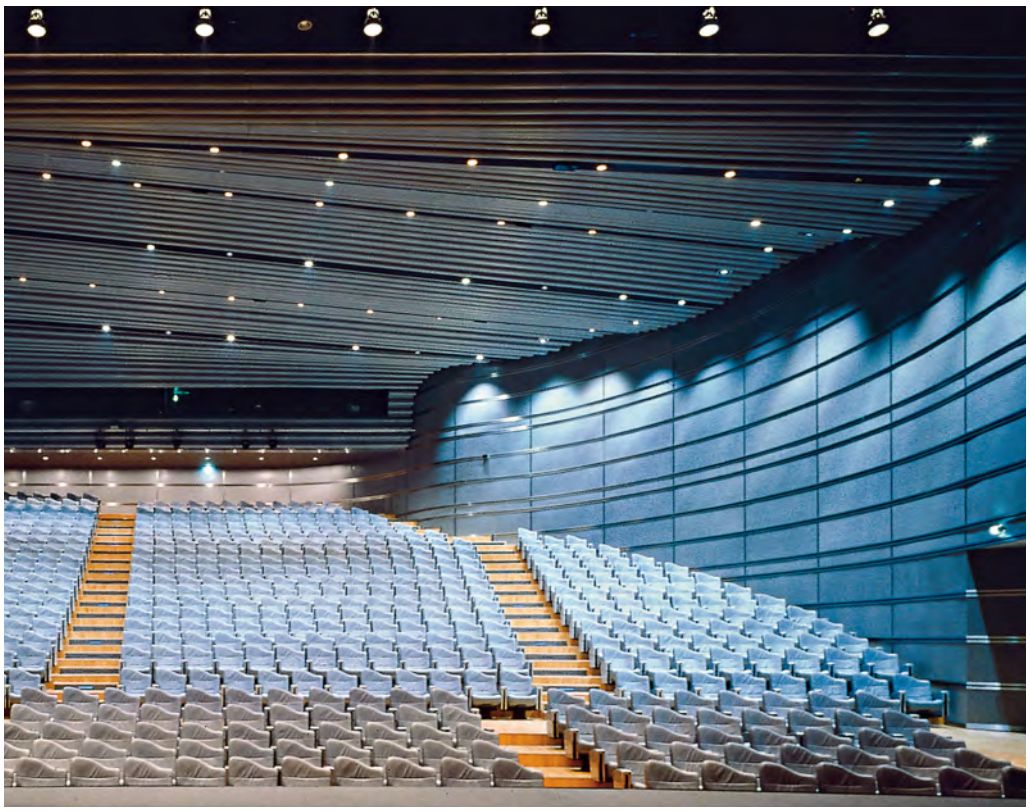


The slots and holes in the 300 mm wide façade panels filter light in the Le Cardo multi-storey car park in Nantes. They also enhance security and promote ventilation.

Photos: Graepel SA, Sabbioneta (top left); PMA, Paris (centre left); Philippe Ruault, Nantes (centre right); Roulleau Architectes, Nantes (bottom)

A range of structures can be achieved by combining cutting and pressing techniques. First slits are cut into the stainless steel sheet in a regular pattern, and then the resulting strips of metal bent either upwards or downwards. The proportion of open to closed surface depends on the width of the continuous 'bridges' between the slits, the length of the slits and the style of deformation. These highly stable and yet still permeable sheets are used as effective acoustic cladding for walls, for example, or decorative screening panels to protect against the elements.

The curved wall in the hall of the Palais des Congrès in Reims is fitted with stainless steel sheet (grade: EN 1.4306, 2R) with a slit bridge structure.



Metal sheet with a slit bridge structure is familiar from filter technology, but its rigidity and light permeability makes it suitable for architectural applications, too.

Photos:
Tolartois, Béthune (top);
Moradelli, Kirchheim near Munich (centre); Georges Fessy, Paris (bottom)

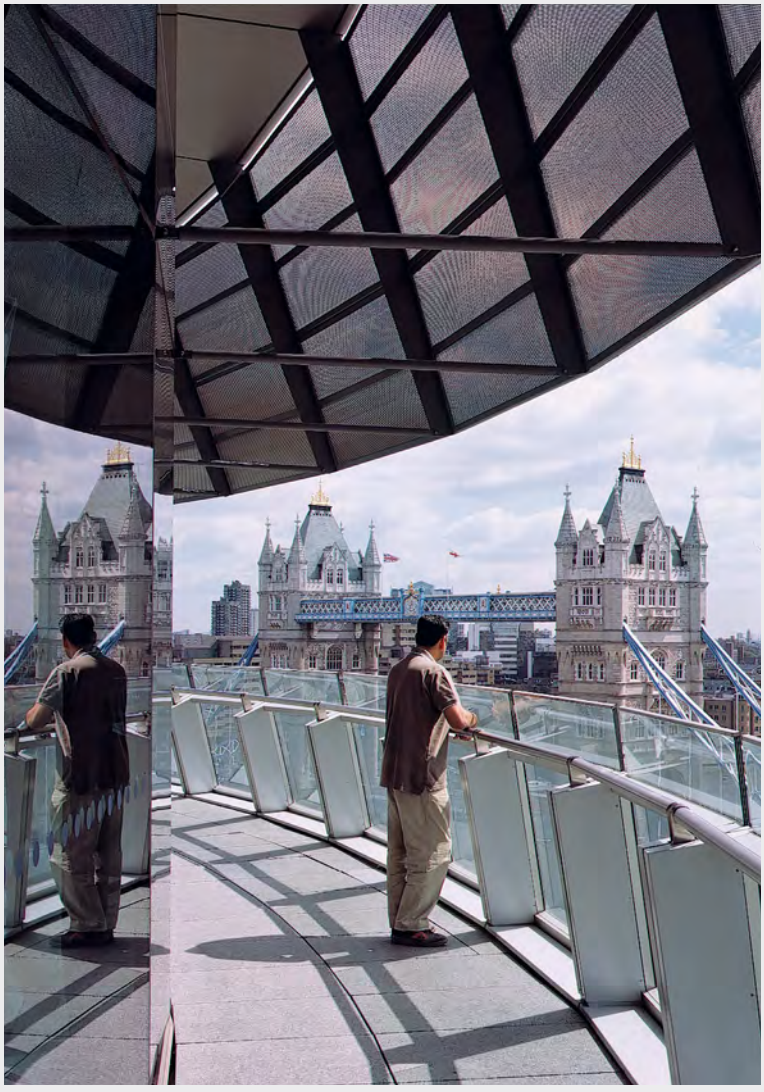
The shape and orientation of City Hall reduce the building's energy consumption and maximise the interior volume.

Photos:
Foster and Partners, London

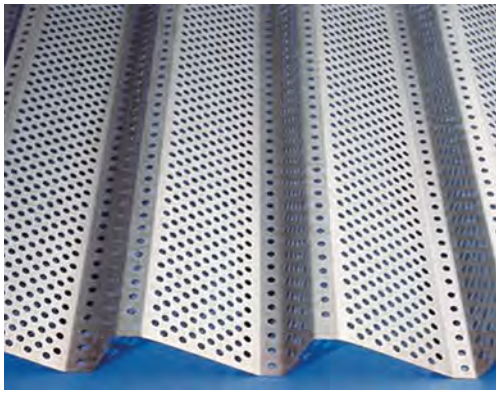
City Hall in London, England

Clients:
CIT Markborough Properties, London
London Bridge Development
Greater London Authority
Architects:
Foster and Partners, London
Structural engineers:
Arup, London

'London's living room', a public events room, is located on the top floor of City Hall. The top of the façade is finished with a ring of metal sheet with a slit bridge structure above the viewing terrace. Although only 0.8 mm thick these sheets meet the highest specifications – they let in enough daylight and provide stylish protection against the weather, while also withstanding the structural stresses imposed by wind loads at 50 m above the ground.

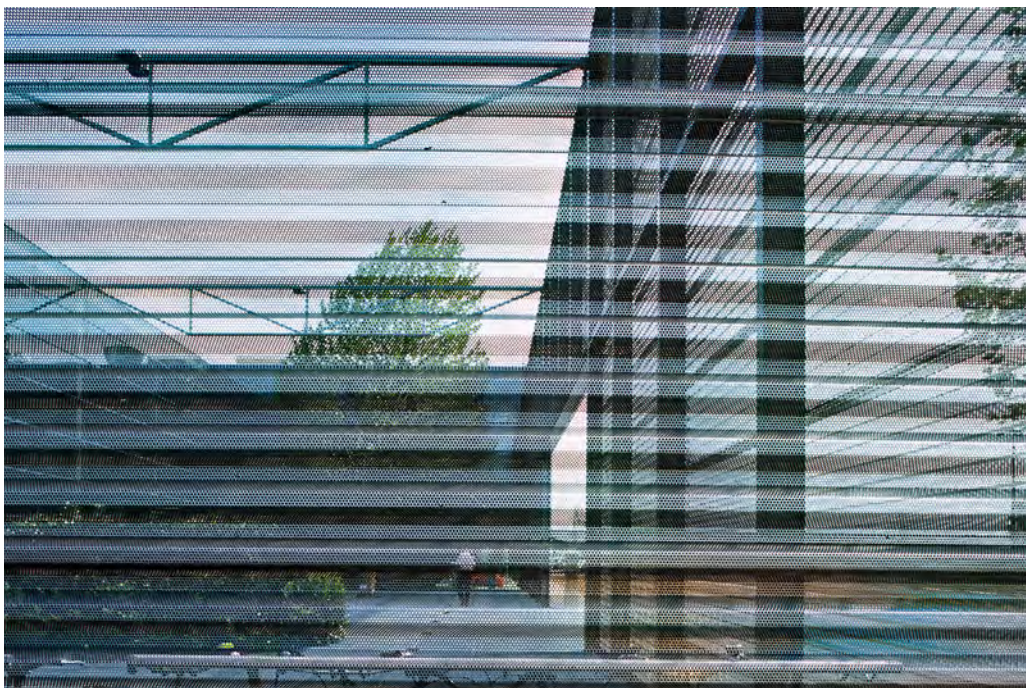


When bent into profile shapes, perforated stainless steel sheet becomes a rigid panel for use in cladding floors and walls. The perforations filter sunlight and avoid glare effects in interiors.



Photos: PMA, Paris (top); Paul Maurer, Paris (centre); Architectenbureau cepezed b.v., Delft/Fas Keuzenkamp, Pijnacker (bottom)

In Charles-de-Gaulle Airport in Paris, trapezoidal stainless steel sheet with 68 mm perforations is mounted on the outside of the glazed departures hall to protect the interior against the sun.



Here in the Dutch town of Woerden a semi-transparent screen separates off the courtyards of an office and production building from the street. The 10 m high walls are of perforated, trapezoidal stainless steel sheet (grade: EN 1.4436, 2B surface) with an open area of 50%.

Fire Station in Nanterre, France

Client:
Préfecture de Police, Nanterre
Architects:
Jean-Marc Ibos & Myrto Vitart, Paris
Structural engineers:
Khephren Ingénierie, Arcueil

Arranged in a horseshoe shape around an inner courtyard, this fire station on the outskirts of Paris is clad with trapezoidal stainless steel sheet (grade: EN 1.4306, 2R finish). The high-gloss building envelope extends across all the outer walls and roof surfaces. At regular spacings, horizontal windows interrupt the vertical structure of the façades. Perforated areas in the trapezoidal sheet allow more daylight into the interior of the building, while retaining the closed character of the façade from the outside.

This U-shaped fire station complex, with its cladding of trapezoidal stainless steel sheet, forms the base of a residential block, above the top end of the 'U'.

The perforated surfaces in the façade and on the roof enable daylight to penetrate down to the forecourt areas.

Photos: Georges Fessy, Paris (top, bottom right); Tolartois, Béthune (bottom left)

Expanded Mesh

Expanded metal mesh is a semi-finished product with diamond-shaped openings that are formed by cutting and at the same time stretching stainless steel panels or strips. The size of the mesh openings is determined by the length of the parallel cuts made across the area of the sheet. Unlike perforations, this involves no loss of material, as the incisions are simply deformed through the stretching process. After stretching the expanded mesh can be rolled flat to regain its original material strength. Mesh styles include diamond, square and hexagonal shapes, and also special shapes. Depending on mesh length and width, web width and material thickness, a range of visual effects can be achieved, with varying degrees of transparency.

The curved, transparent sail suspended from the ceiling is made of expanded mesh (grade: EN 1.4301). It acts as an acoustic insulator for the noise from the bistro below in this shopping centre in Genoa (Italy).

Expanded stainless steel (grade: EN 1.4301), electrolytically coloured red and gold, wraps around the façade of an administration building in Salzburg.

Photos:
Fils S.p.A., Pedrengo (top);
INOX-COLOR GmbH & Co. KG, Walldürn (bottom)

Different mesh geometries – electropolished and with a standard mill finish.

High inherent stability coupled with a comparatively low own weight enables the production of very rigid elements which have high tensile strength. In addition expanded mesh can be cut to size without losing its stability or shape. There is a wide range of applications for expanded mesh – railings and fences, façades and ceilings, exhibition stand design, shopfittings, etc. This inexpensive material is also ideal as a space divider, a visual screen or to shade against the sun.

The variety of functions in the interior is reflected in the changing outer face of the building. Fixed panels of expanded metal are interspersed with sliding ones, which the users can position as required.

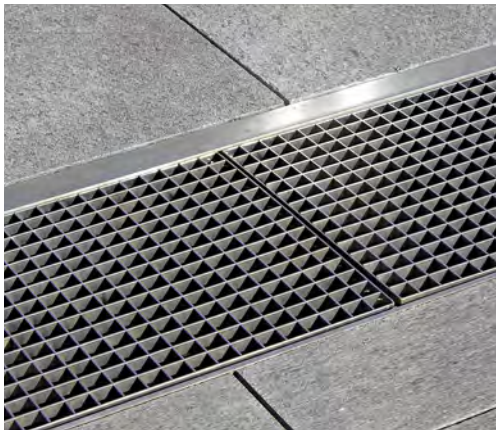
The workshops at the Bauhaus University in Weimar, designed by av1 architekten of Berlin, are wrapped in a protective skin of panels of expanded stainless steel mesh that shade against the sun.

Photos: Métal Déployé, Montbard (left); Michael Heinrich, Munich (centre right, bottom)

Grating

Grating is a grid made up of bar or strip in one direction slotted across supporting bar or strip in the other direction. The longitudinal and transversal elements are either pressed or electrically welded together. The resulting regular pattern is available in a range of grid spacings. Even variable spacing is now possible thanks to modern CNC manufacturing processes.

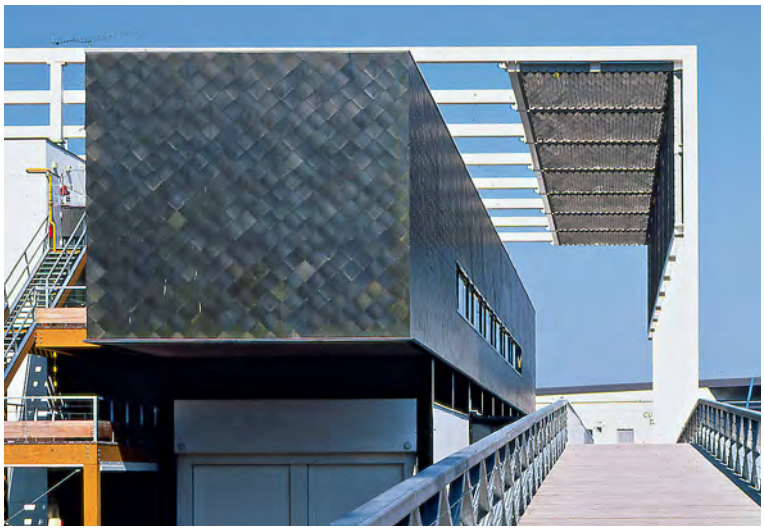
Grating uses little material (around 80% of the surface area is open) yet it has very good load-bearing performance. If profiled bars are used, special surface properties, e.g. an anti-slip finish, can be achieved. Generally the edges around the grating are finished with flat-steel or angle profiles, to give stability to the grid structure.



With changing viewing angles and viewing points, the visual impression of grating alters from fine and transparent through to opaque. By setting the bars at an angle, the grating can be used for solar shading or to deflect light.

On the parliament building for the State of Saxony in Dresden, the concrete base facing the banks of the Elbe is clad with metal grating.

Welded stainless steel grating is used as solar shading on the Mediathèque in the French town of Sélestat.



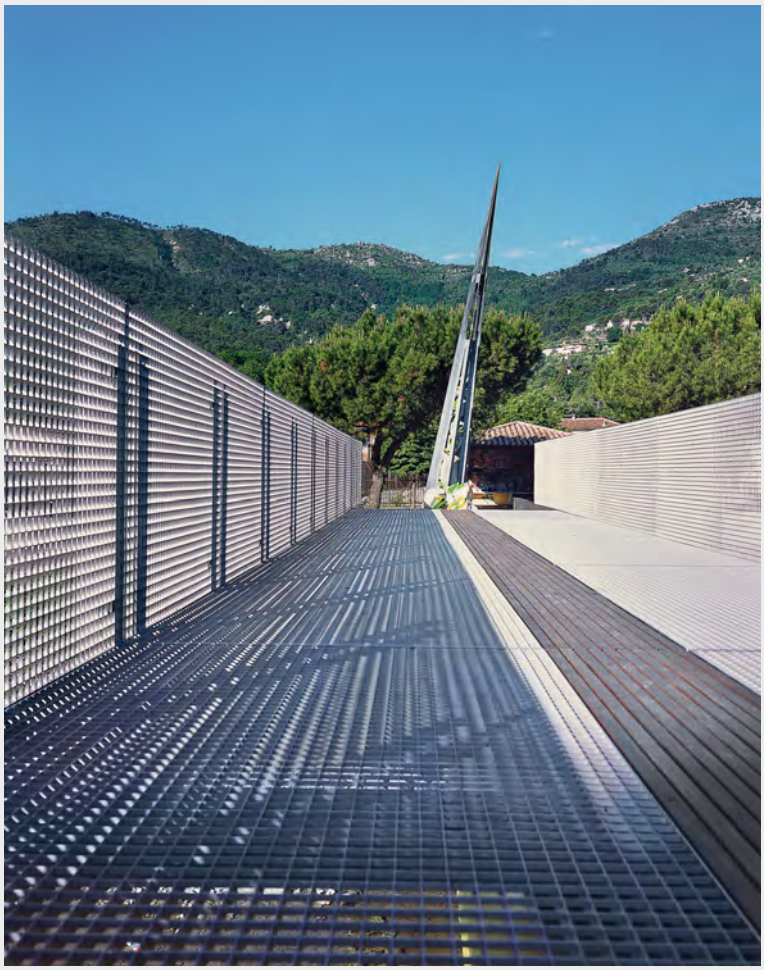
Photos:
Martina Helzel, Munich (top right, centre left);
Luc Boegly/Artedia, Paris (bottom right)

Photos: Serge Demailly,
La Cadière d'Azur

Footbridge in Contes, France

Client:
Ville de Contes
Architects:
Atelier Barani, Contes
Bernard Pagès (sculptor)
Structural engineers:
Sudéquip Ingénierie, Nizza

The architects worked together with a sculptor to create the clear lines of this footbridge in Contes, not far from Nice. The river bed is spanned by a yellow painted steel beam, the walkway itself and the railings are made of stainless steel grating with a mesh size of 33 x 33 mm. The individual grating panels are 1026 x 2478 mm.



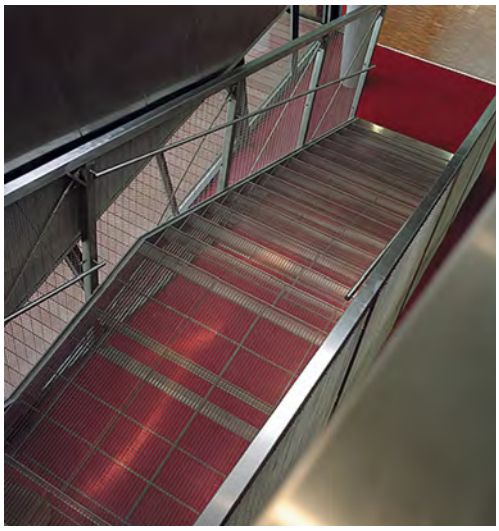
Architectural grating is a special form of grating. Wedge wire screens, originally developed as filters for technical applications, are now being used in architecture and design, for interior and exterior applications, because of their visual appeal and the interesting interplay of light and shade that they create. Wedge-shaped bars and support profiles are variously combined to produce a variety of different structures. The individual junctions are welded, meaning that even curved forms remain stable, and therefore no complicated frame is needed.

The bars generally have a triangular cross section and are welded to rectangular supporting profiles.

In the Maritime Museum in London the restrained transparency of the modern interior fittings blends well with the existing historic building.

Photos:
Euroslot, Scorbe Clairvaux/
Michael Gompf, Nürtingen

Because of its high strength, grating can also be used for airy staircase designs, such as here in the Pierre Baudis Congress Centre in Toulouse.



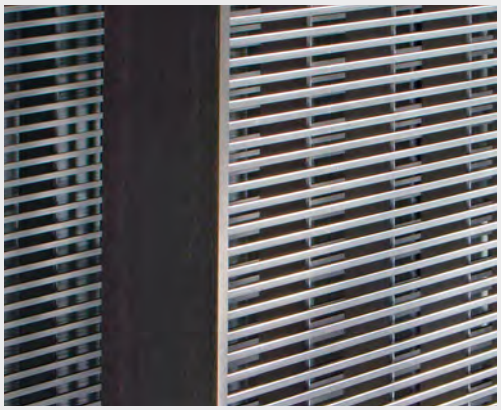
Training Centre in Stuttgart, Germany

Client:
Robert Bosch GmbH, Stuttgart
Architect:
Peter Kulka, Cologne
Structural engineers:
Horz & Ladewig, Cologne

A flat, metallic cuboid building with a glazed base houses the lecture and seminar rooms of a training centre in close proximity to the old Villa Bosch. The full-height glazing on the upper storey is set back behind the floor slabs clad with dark steel sheet. In front of the glass are sliding panels of stainless steel (grade: EN 1.4404) to shade against the sun. These panels are made up of a grid of vertical supporting bars (25 x 2 mm) spaced at 50 mm and horizontal profile wires spaced at 5 mm, held in a flat-steel frame.

Photos: Lukas Roth, Cologne (top, bottom); Euroslot, Scorbe Clairvaux/Michael Gompf, Nürtingen (centre)

The sliding panels of stainless steel grating and the ends of the cantilevered floor slabs combine visually to create a compact box effect.

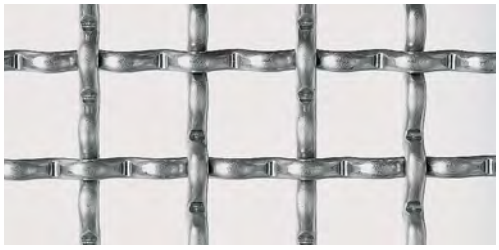


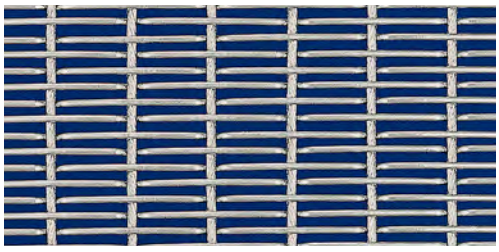
Within each group of three panels, two are sliding. Moiré effects are created when the grid structures are overlaid.

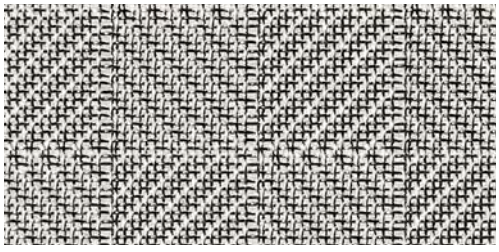
Woven Metal

Set at a diagonal angle into perimeter profiles, rigid woven stainless steel is used here as a railing on Torre Agbar in Barcelona.

Stainless steel in the form of cables, cords, round or flat wires can be woven, like textiles, to create a weave structure. Special weaving 'looms' are used in which the cross or 'weft' strands are interlaced through the lengthwise 'warp' in a range of weave patterns; the resulting woven metal is available in any length and in widths of up to 8 m. Depending on whether rigid metal wire is used, or softer, woven cord, it is possible to create structures that are flexible in one or two directions, or very stiff structures, such as woven wire mesh.







The choice of weave pattern, wire thickness and mesh width determines the final effect and also the possible applications for woven stainless steel.

The staircase in an administration building in Langenthal is made of woven wire mesh, made from 4 mm thick wire and with a mesh size of 40 x 40 mm.

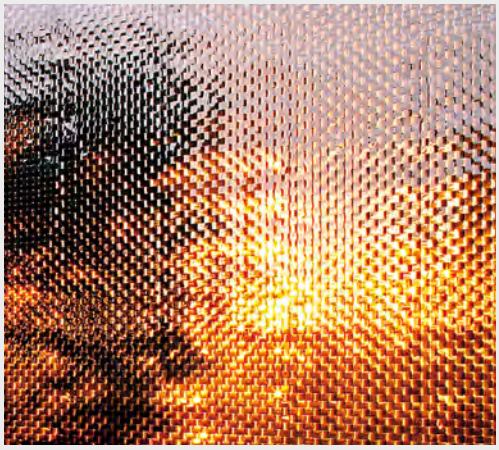
Photos: Stefan Zunhamer, Munich (top right); MEVACO, Schlierbach (bottom right); Haver+Boecker, Oelde (top left, bottom left); Gebr. Kufferath AG, Düren (centre left)

Administration Building in Heilbronn, Germany

Client:
Südwestmetall Stuttgart
Architect:
Dominik Dreiner, Gaggenau
Structural engineers:
Werner Sobek Ingenieure, Stuttgart

Photos: Johannes Marburg, Berlin

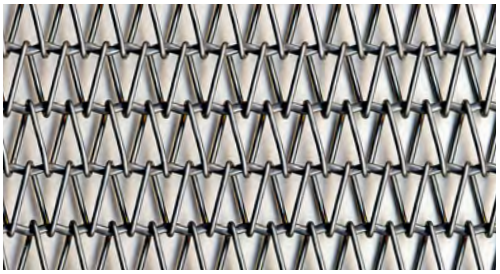
The woven stainless steel 'fabric' wraps neatly around the edges of the single-storey building.



The metallic weave reflects a blurred image of the surroundings.

The woven metal used on the building skin here is made from 0.4 mm thick and 50 mm wide stainless steel strips processed on a special 'loom' to create long lengths of woven 'fabric'. During transport and assembly a flat plastic grid supported the individual lengths. The approximately 1 m x 4 m large mats are attached to the steel frame of the façade via disk fixings at the abutments. The vertical and horizontal joints between the metal panels were interwoven on site by hand.

Depending on the size and thickness of the interwoven spirals, the result is a highly transparent or opaque surface with a textile look.



Photos: Michael Gompf, Nürtingen (top left);
Stefan Zunhamer, Munich (top right);
Erich Schröfl, Traiskirchen (bottom left, bottom right)

One special form of woven metal is spiral weave. Here round or flat wires are either interwound directly around each other, or around a straight or wavy chain. Developed originally for use as a conveyor belt in industry, this type of weave is increasingly finding application in architecture because of its flexibility and good tensile strength.

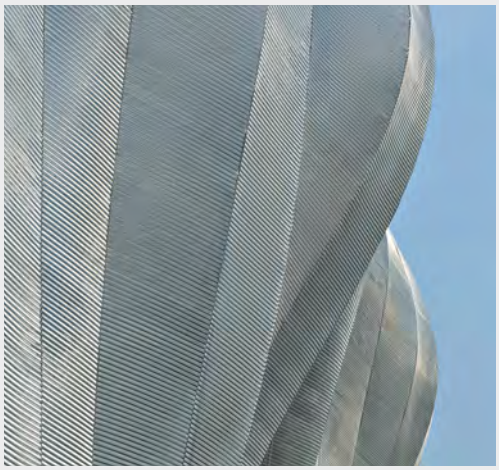
This annexe to a restaurant in a converted dairy in Vienna is enveloped in fine spiral-weave stainless steel.

Arts Centre in Lille, France

Client:
Ville de Lille
Architects:
NOX/Lars Spuybroek, Rotterdam
Structural engineers:
Maning, Lille

63 panels of spiral mesh, up to 13 m long and an average of 1.30 m wide, were used on the three-dimensional shape of the façade of this arts centre. The panels are point fixed to a shaped façade frame. Each individual panel in the 1,100 m² façade was made to a template with a different curvature. The mesh (grade: EN 1.4404) is made of 1 mm thick and 2.8 mm wide stainless steel strips wound into spirals over 2 mm thick round bars. The open area is 36%.

The spiral mesh wraps around the three-dimensional façade of the Maison Folie Arts Centre in Lille as if blown there by the wind.

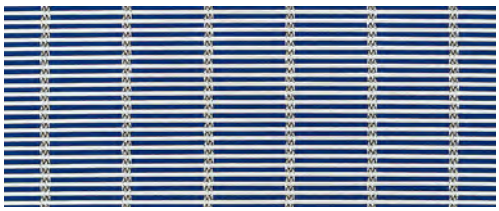


A special weave style enabled the creation of three-dimensionally curved façade panels; at night they are illuminated from within.

Photos: Paul Raftery/View, London (top, centre); NOX/Lars Spuybroek, Rotterdam (bottom)

The curved façade of the Clarence Dock multi-storey car park in Leeds is made of woven stainless steel (grade: EN 1.4404) with an open area of over 60% to ensure good ventilation.

An incredible variety of woven-metal styles can be made by using different weaving processes, depths, mesh widths and material thicknesses. Suitable solutions can be found for just about any application, from very fine and decorative or flexible weaves to robust structures with high mechanical stability. Also, thanks to its corrosion resistance, woven stainless steel is ideal for use in outdoor applications.



Photos: GKD - Gebr. Kufferath AG, Düren

Woven stainless steel covers the full height of this wall at the Privilege Club in Athens, partitioning off the restaurant area and serving as a giant-sized projection screen.

A woven panel stretching up nine storeys forms the parapet of the staircase in the atrium of the Sanoma building in Helsinki.

The extensive wall cladding in the National Gallery of Victoria, Melbourne, is made of woven stainless steel fixed in a perimeter frame.

Photos:
Jussi Tiainen, Helsinki (top left); GKD - Gebr. Kufferath AG, Düren (top right, centre right); Mario Bellini Associati, Milan (bottom left, bottom right)

The stainless steel weave of the curved façade protects travellers against the weather and, at night, the parked trains against vandals.

Station in Worb, Switzerland

Client:
Regionalverkehr Bern-Solothurn RBS
Architects:
smarch – Beat Mathys & Ursula Stücheli, Bern
Structural engineers:
Conzett Bronzini Gartmann AG, Chur

Each one of the 1.5 mm thick and 230 mm wide strips stretches in a single length along the entire 130 m hall.

Photos: Thomas Jantscher, Colombier

Friction alone keeps the stainless steel strips in place on the columns. The necessary tension is achieved by clamping the strips together using turnbuckles.

The loose open-weave effect on this long curving façade was achieved by threading stainless steel strips around stainless steel columns (grade: EN 1.4435) filled with concrete. The strips (grade: EN 1.4462) were fixed at the ends, drawn across the columns in parallel and clamped together using rhythmically spaced turnbuckles. The resulting wrapped-metal envelope filters the light and, through an interplay of light, shade and reflections, gives a depth effect to the façade.

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