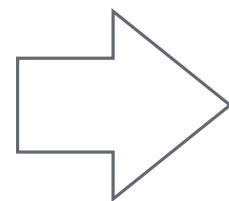


FAÇADE IN FOCUS:
ELBPHILHARMONIE, HAMBURG, GERMANY

Façade as art





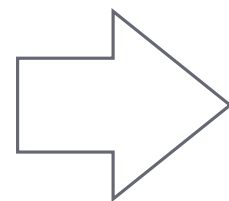
At the turn of the millennium, the city of Hamburg in Germany launched a renewal scheme for its docks area to the south of the old town. The ambitious project aimed to create a new residential, commercial, cultural and tourist destination, with a landmark new concert hall at its heart – Elbphilharmonie.

Built on top of a former warehouse, the new philharmonic building was designed to drive regeneration for the whole district. The vision of Swiss architect Herzog & de Meuron, the building integrates the classic characteristics of a philharmonic hall with a variety of private and public functions:

“Too often, a new cultural centre appears to cater to the privileged few. In order to make the new Philharmonic a genuinely public attraction, it is imperative to provide not only attractive architecture, but also an attractive mix of urban uses.

Herzog & de Meuron





In line with this, as well as two concert halls, Elbphilharmonie is home to restaurants, bars, a panoramic terrace with views over the port and the city, luxury private residences, a hotel and a parking area. Since its opening in 2017 it has become a beacon for the city and Germany, attracting visitors and the business world.

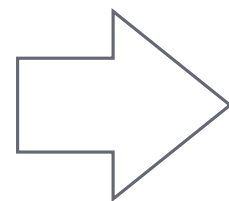


© Herzog & de Meuron Basel/Elbphilharmonie Hamburg/bloomimages

A UNION OF PAST AND FUTURE

The warehouse that formed the starting point for Elbphilharmonie, known as Kaispeicher A, dated back to the 1960s and had been used for almost four decades to store tea, tobacco and cocoa. With a monolithic appearance typical of the local industrial tradition, including a cold, regular façade with uniform openings, the form, colour and material of Kaispeicher A created a striking base for the block of crystal that now sits above it.

The only part of the former storehouse to be retained was its external walls. The inside was gutted and now offers space for parking and a studio for musical education. The 'Tube', an imposing 82m tunnel with curving escalator, leads to an enclosed loggia, which links the base to a covered plaza. The 4,000 sqm public space includes an external walkway at a height of 37m that runs all the way around the building, offering spectacular views over the docks and the city.



The majestic new glass building rises from the plaza, topping out at 110m at its crest. The main concert hall, which seats 2,100 people, is a masterpiece of structural engineering, consisting of a volume suspended 50m above floor height. A smaller recital hall seating 550 people is used for a variety of performances, including chamber music concerts. The eastern face of the building houses 250 five-star hotel rooms and features a spa and business centre. The western face houses 45 luxury private residences, featuring glazing and terraces that look directly out onto the Elbe River, the seafront and the city.

As the building's different functions require a variety of lighting, ventilation and levels of privacy, the designers meticulously researched the envelope's configuration and technology to adapt to these wide-ranging needs.



DESIGN AND ENGINEERING: A MIX OF COMPLEX ELEMENTS

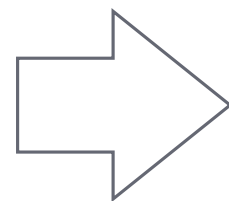
The envelope's extreme complexity – combining irregular, semi-transparent façades with specially-developed technological solutions – made it a milestone in curtain wall technology.

The design incorporates a variety of elements that make each façade unit more or less unique by leveraging a series of bespoke innovative systems:

- units with multiple textures and different protective layers
- alternating, spherically-curved units
- special loggias known as 'tuning forks' integrated into the façade
- glazing for the loggias
- inclined glazing for light wells
- massive wind deflectors.

Covering a total surface area of 21,800 sqm, this is a truly bespoke façade development the likes of which had never been seen before.





DESIGN AND ENGINEERING: THE MAIN FAÇADE

The main façade rises spectacularly above the plaza, with a sinuous dynamism that results from the way its various components are put together to evoke sea waves and trigger an interplay of reflections.

Consisting of 1,100 prefabricated units that cover a surface area of 16,000 sqm (larger than two football pitches), the glass curtain wall sits on a grid of standard unit modules that are 4.3 x 3.35m in size and weigh approximately 1,500 kg. Extra-height units were installed in the central portions of the north and south façades.

The units are made of double-skin, extra-clear, low iron oxide content safety glass. A variety of treatments were applied to the glass to reduce solar input and give it a constantly-changing appearance, including a double texture formed by reflective chrome-like dots and grey circular screen printing, a solar control coating, and a low-e layer. The texture design varies depending on the function of the space behind the glass, changing from unit to unit to create a unique mesh across the whole façade.

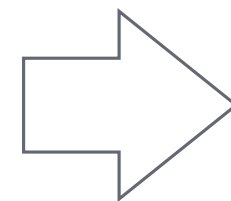


On the west- and south-facing façades, the façade design needed to be adapted to take into account radar visibility and ensure shipping safety within the port. The thickness of the glass, exact positioning of the screen-printed dots and the special treatment curves were all carefully modified to ensure no interference to radar.

“The real development and innovation lies not in every element of the façade, but in the complex combination of all of these individual elements, in addition to their performance and aesthetic requirements; this is the reason for its uniqueness.”

Permasteelisa Group Project Manager, Elbphilharmonie



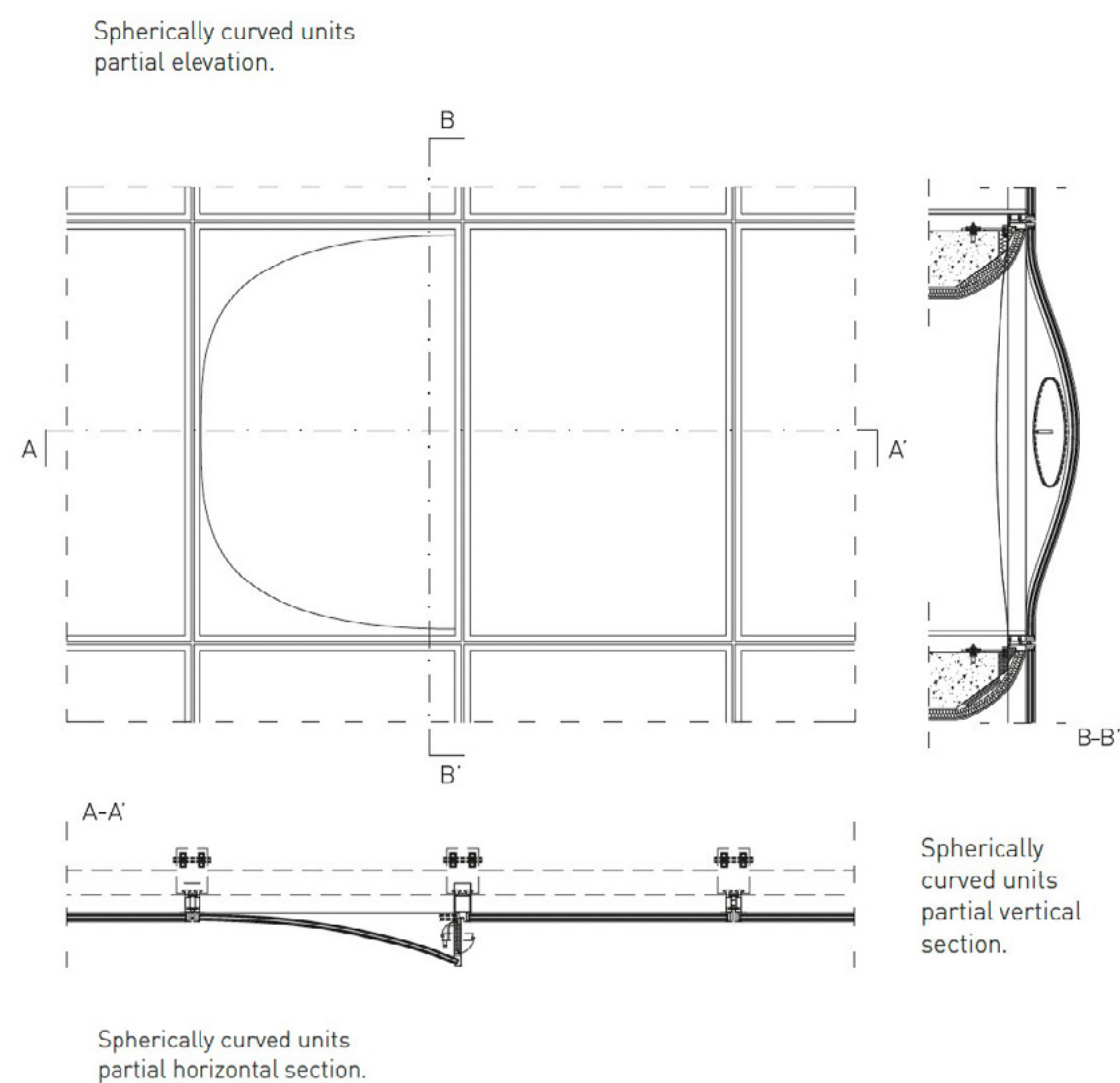


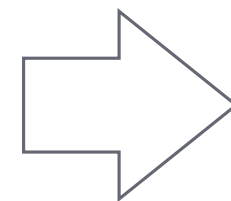
The second complex feature of the façade is its spherically-curved glass units.

In total, 600 of the 2,200 glass panes used on the building feature complex spherical curvature that bends either towards the interior or exterior, curving 350mm from the façade's vertical plane. To create different effects, laminated panels were combined in a variety of different designs: panels with the same curvature, flat panels with curved panels, and concave with convex. Some 300 of the units were also fitted with a 'porthole' – an oval window that opens by revolving on its central axis to enable natural room ventilation.

Engineering a double-curved surface is extremely challenging; all the more so when the materials used require a large number of treatments. The project working group spent around two years researching this job, increasing and expanding its knowledge base on glass bending and leveraging experience and expertise from across Permasteelisa Group. BIM tools and 3D modelling proved invaluable for the detailed development of the most complex elements.

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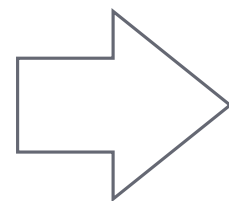


DESIGN AND ENGINEERING: TUNING FORKS AND WINDBREAKS

The luxury private homes that run along the western, north-western and south-western sides of the building feature balconies that offer unforgettable views over the city. To find a solution for achieving this while preserving the continuity of the curtain wall, over 100 special elements were manufactured for the loggias, with shaped balustrades conjuring up the image of tuning forks. A further six extra-large tuning forks – 6.45m wide and 5m high – were created for the external balconies of the concert hall.

Made up of two glass panels, these special units feature outwards-jutting spherical curvature and an integrated fibreglass-reinforced polymer profile. Stainless steel brackets were laminated into the glass fibre to fix the outwardly curving elements to the façade elements. On the room side, 1,400 sqm of loggia façades comprising openable sliding doors, pivoted doors and curved glass units were installed, forming light, airy open spaces between the inner and outer façade.





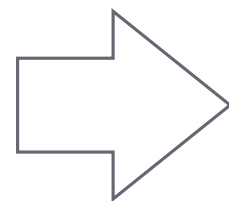
Located at a height of 37m and exposed directly to the strong winds and currents of the North Sea, the Plaza needed to offer shelter to visitors. To achieve this, a 2,100 sqm stick system steel façade with two monumental curved glass walls runs along the longitudinal sides of the building. These open up to reveal large façade cutouts overlooking the inner city and the harbour.



© Cordelia Ewerth

To create access points, 28 sinuous S-shaped windbreaks, reaching a height of 6m and a diameter of 2.5m, were made from panes of curved, laminated safety glass and plastic PVB film. Most of these are fixed – anchored to the floor and ceiling using U-shaped steel profiles that follow the wavy profile of the glass. Six that can be opened are on revolving hinges supported on floor-concealed ball bearings and anchored to plates coplanar to the concave surface of the ceiling. The deflectors are opened and closed by revolving on their vertical axis via a ceiling-mounted mechanised system.

The building's wave-shaped roof is made from eight concave sections that form a series of peaks and valleys. A partially-inclined stick system façade in line with the apartments and hotel creates two light wells that penetrate into the spaces behind. Operable sliding doors permit access to the panoramic terracing.

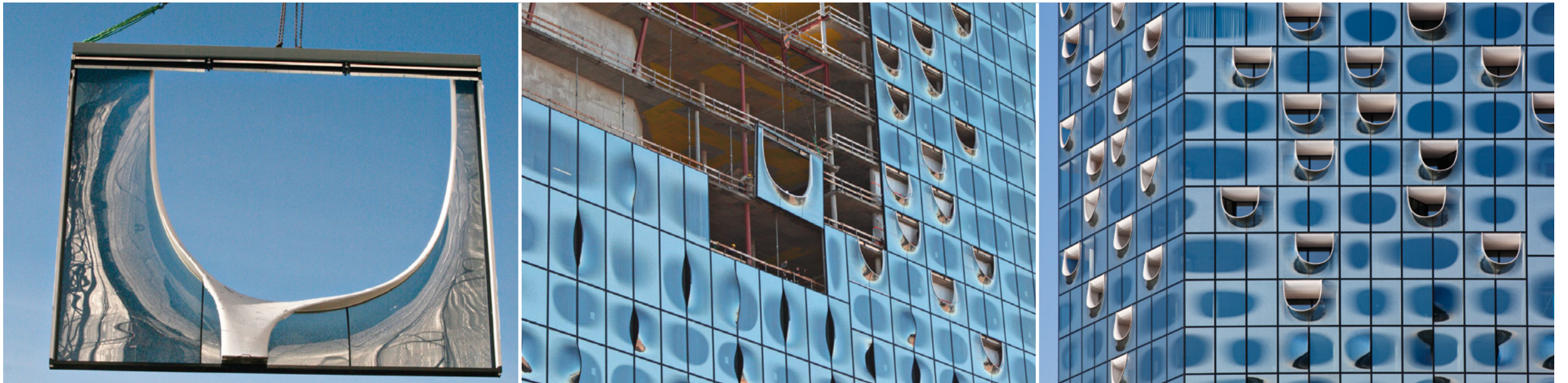
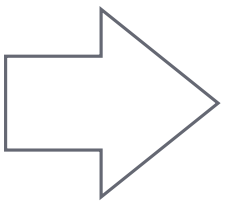


MOCK-UPS AND TESTING

Before Elbphilharmonie was constructed, there was nothing like it on Earth. To ensure that all standards were complied with, the façade units with their unique technological elements were meticulously tested to certify compliance with reference standards on airproofing, waterproofing, windproofing and impact resistance.

Given the peculiar formation of the spherically-curved panes of glass and the special treatments applied, no certification institute would have been able to conduct the compliance tests needed. As a result, Permasteelisa Group set up a research project with leading academic institutions to demonstrate the system's validity, which led to the development of a dedicated test rig facility at Gartner's headquarters in Gundelfingen to test resistance to the most extreme thermal conditions. A whole series of tests, checks and adjustments followed, leading to the creation of the final façade.





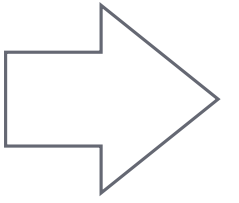
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FACTORY TO SITE

A specialist procurement and materials processing team was set up for the meticulous coordination of the different types of glass and variety of processing methods needed for this complex façade. To cope with the dimensions of the panels and the specifications that had to be complied with, it was even necessary to design and build a bespoke furnace!

The 1,100 special façade units were prefabricated in Gundelfingen and, after passing strict final quality control, transported to the site in Hamburg. A hydraulic-inclined loader was used for the six extra-large tuning forks, to allow them to be positioned at the right angles to meet maximum height and width requirements.

To manage such a large number of unique façade elements, each panel was mapped and equipped with an RFID (Radio Frequency Identification) chip that, thanks to a specific ID number, could remotely identify each individual element. This facilitated the transportation of units at a site that was particularly challenging given its unique geographical location and space constraints. Traceability contributed to precise organisation of installation, as well as providing a database of information on each panel's specification. This same data has since also been used for maintenance purposes.



FROM INDUSTRIAL BUILDING TO CULTURAL VENUE

After Herzog & de Meuron's successful work at the Tate Modern in London and the CaixaForum in Madrid, Elbphilharmonie once again demonstrates the architect's enormous skill in converting old industrial buildings into museums, concert halls and cultural venues.

Since it opened, the concert hall has driven the revival and renewal of Hamburg docks. As a building, it brings together the Swiss architect's vision and PermaSteelisa Group's expertise to create modern temple to music – a fantastic example of façade as art.



This issue of Façade in Focus is adapted from the book Complexity and Eternal Beauty, published by Permasteelisa Group in 2017.

PROJECT CREDITS

Client: Freie und Hansestadt Hamburg

Architect: Herzog & de Meuron

Contractor: Hochtief Solutions

