

press release

The exhibit 'Gravity' shows the potential of thin glass

From 23 to 26 October 2018 the 25th glasstec (International Trade Fair For Glass Production - Processing - Products) will take place at the Düsseldorf Exhibition Centre. A car swinging upside down suspended only on two sheets of super-thin glass. 'Gravity' is a collaboration between Define Engineers, Carpenter | Lowings and seele and will be shown at the glass technology live show.

Gersthofen, 22 October 2018. A car swinging upside down suspended on only two sheets of super-thin glass: 'Gravity' is showcasing the potential in glass processing, adhesives, high precision engineering and manufacturing in a highly innovative, efficient and aesthetic design.

Two sheets of thin glass elegantly bonded to stainless-steel edge strips are suspended from a tripod structure which holds the swinging car very close over a podium. The glass sheets are 1 x 2m, composed of two 2 x 2mm heat-strengthened laminated glass panes. The load bearing capacity of this visually and physically light structure is impressive.

State-of-the-art engineering

The team at Define Engineers relies on state-of-the-art engineering methods to determine the behavior of the 1.5 t car pendulum as it swings. A simulation called Non-linear Transient Dynamic FE analysis captures the hanging and dynamic nature of the system. The results are used to design all components of the exhibit. The thin glass stretches under the dynamic load of 1.35 t, which eliminates all bending and ensures that the glass behaves as a membrane - the most efficient way to carry load.

A key feature of Gravity is the transparent connection between the glass and the stainless steel brackets

The permanent stress in the TSSA layer, estimated at about 0.6 N/mm², is further increased by the dynamic effects of the swinging car to ~0.7 N/mm². seele, the façade construction specialist, carried out structural performance tests to confirm the TSSA reliability utilising samples of thin glass with a size of 400 x 600 mm. The test TSSA bonding area of 300 x 40 mm had to transfer a permanent load of 4.5 kN resulting in local peak stresses of about 0.6 N/mm². The short- and long-term tests were successful with an ultimate load capacity of 53 kN.

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The size and optimum shape of the stainless steel connections were designed and manufactured by seele. The special competence lies in the minimal design of the connections, the bonding and the aesthetically high-quality execution. The stainless steel brackets are milled and a fork is welded to the bracket. In the last fabrication step, seele is polishing the metal surface. The bracket is designed to transfer the dynamic design load of 13.5 kN.

The thin glass with a size of 1 x 2m is laminated and the metal stripes are bonded to the glass. seele was also responsible for the preparation of the car, the design and manufacturing of the suspension points on the vehicle.

'Gravity' - a team effort

Collaboration is what makes intense design and construction efforts like this possible. It arises when working relationships turn into friendships, when equal interests form concepts and find their expression in the finished work. Knowledge and confidence gained in small projects may find application at a larger scale. That is why the understanding of glass is strengthened on a theoretical and practical level and thus becomes part of the building culture.

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seele group of companies

The seele group, with headquarters in Gersthofen in Bavaria, is one of the world's top companies specialising in the design and construction of façades and complex building envelopes made from glass, steel, aluminium, membranes and other high-tech materials. The technology leader in façade construction was founded in 1984 by master glazier Gerhard Seele and steelwork engineer Siegfried Gossner.

Based on a profound understanding of design and materials, seele provides everything necessary for ambitious one-off designs true to the original ideas of engineers and architects. The seele group offers its building sector and industrial customers a complete package of services ranging from R&D, individual advice and joint conceptual design right up to the planning, detailed design and construction of their projects. seele's own production plants for technologically challenging designs and the group's own erection crews on site provide a guarantee of the very highest quality "made by seele".

The 1,000 employees of the seele group worldwide together generate an annual turnover of about €250 million.

Contact for the press

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Carpenter | Lowings, London, UK

Carpenter | Lowings was founded in 2001 to develop a synthesis of structure, light and space in an architectural and urban context. The studio has been instrumental in the development and refinement of the use of structural glass and has consistently produced projects of high visual and technical quality.

We approach every project as a unique challenge and develop original concepts through all phases of design and practical delivery and can assemble and lead teams with trusted and experienced engineers, lighting designers, materials specialists and fabricators. Our work always aims to synthesise the aesthetic and structural in response to the physical context, budget and timescale.

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Carpenter | Lowings was honoured as Architect of the Year in the Lighting Design Awards 2017.

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Define Engineers Ltd, London, UK

Define Engineers is a London based practice of structural and building envelope engineers founded in 2017. At the core of the firm are the virtues of ingenuity and precision which filter through the work we do. The company is formed as a collective idea to enjoy the challenges of inventive design engineering. Vlad and Andy, the founders, have more than 20 years of combined experience in the fields of complex structural and facade engineering. They have lead and managed some of the world's most innovative award-winning projects. At Define Engineers we believe quality engineering can deliver exceptional value to our clients and to society. At Define Engineers we collaborate with the world's most talented architects and designers.

We define our work as inventive engineering, harvesting the power of computational design, advanced analysis, contemporary materials and modern manufacturing processes.

We offer structural & facade engineering as well as geometry and software consultancy at any stage of the project development. We engage for commissions on newly built, existing buildings and arts projects.

Contact for the press

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Images and video



The exhibit "Gravity" at its final position at glasstec.

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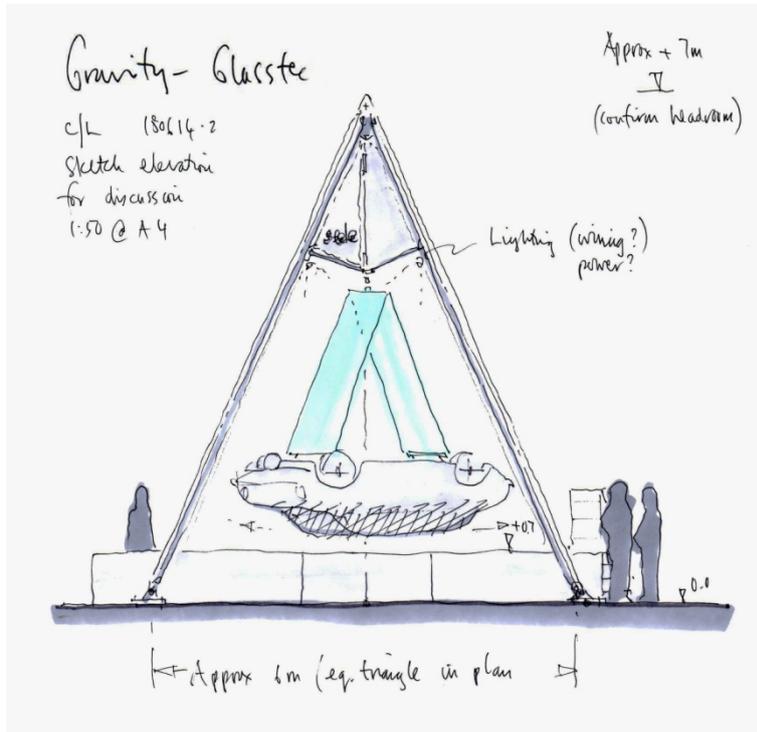
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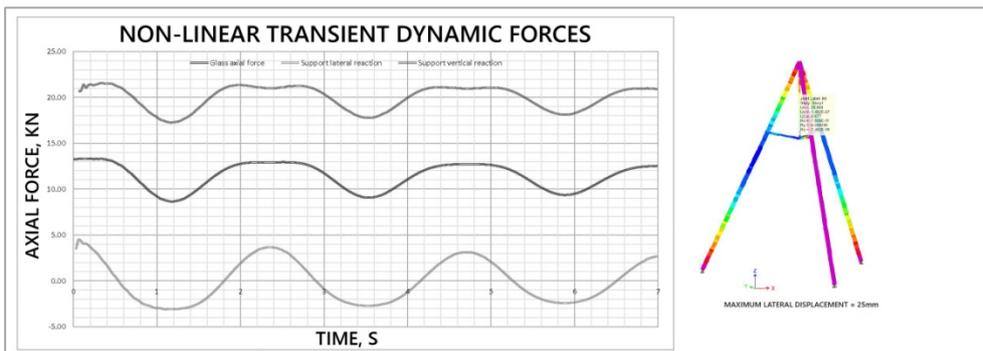
Two sheets of thin glass elegantly bonded to stainless-steel edge strips are suspended from a tripod structure which holds the swinging car very close over a podium.

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First draft of the exhibit by Luke Lowings (C|L)
 © Carpenter | Lowings Architecture & Design



A simulation called Non-linear Transient Dynamic FE analysis captures the hanging and dynamic nature of the system.

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All components were tested in a 1 to 1 test. On this occasion, the assembly process was also tested and optimized.

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