

Heinz Isler

Engineer and shell builder noted for innovative design

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Heinz Isler left a

legacy of more than 1,000 elegant forms all over Europe

The Swiss engineer Heinz Isler, who has died aged 82 following a stroke earlier this year, was one of the great reinforced concrete shell builders of the 20th century. He left a legacy of more than 1,000 elegant yet economical forms across Europe: of those in Britain, the most notable are the roofs for a complex of sports halls and a swimming pool at the Norwich Sports Village (1987-91).

Born in Zollikon, near Zürich, Isler showed talent as an artist while at school, and his first love was art. Nevertheless, his father, a municipal surveyor, advised him to acquire a professional qualification in engineering first. During his studies at the Eidgenössische Technische Hochschule Zürich (the Swiss Federal Institute of Technology, or ETH), Isler chose to study thin reinforced concrete shells as his dissertation subject. On graduation, he assisted Pierre Lardy, a professor at the ETH, and became aware of the value of using scale models to explore the behaviour of structures. Subsequently, still wishing to pursue a career as a painter, he took a job in Burgdorf, north-east of Bern, to support himself while studying at the Academy in Munich.

However, fate intervened and his first project, a concert hall roof for the Hotel Kreuz at Langenthal, near Burgdorf (1954-55), started him on the path as shellbuilder, which he was to pursue for the rest of his life. Its form, designed and constructed as an innovative reinforced concrete shell, was loosely based on the shape of the plumped-up pillow on his bed, which he had noted late one evening while struggling with the roof design.

In September 1959, he presented his work at the first congress of the International Association for Shell Structures (IASS), an organisation just founded by the eminent Spanish structural engineer and shell builder Eduardo Torroja. Until then, the majority of thin, reinforced concrete shells had taken the form of surfaces that could be easily described mathematically – spheres, conoids and hyperbolic paraboloids – to enable the forces and stresses within to be more easily calculated. At this meeting in Madrid, Isler, aged 33, challenged the established technique. Through the use of models, he introduced his revolutionary methods of form-finding shells to an audience that included Torroja and the great Anglo-Danish engineer Ove Arup.

Isler demonstrated three methods of shaping: through using earth mounds, inflated rubber membranes, or hanging cloths, which potentially allowed the design of an

infinite spectrum of new forms, of which he showed 39. The second and third methods generate forms that are in pure tension.

An inflated rubber membrane can be covered in wet plaster and stretched upwards just like a segment of a party balloon, forming a domed surface that can be captured in a cast. At a small scale, wet plaster can shape cloth under the action of gravity, like oranges stretching the net of a mesh bag, and the dimensions of the resulting cast scaled up. When inverted, these shapes formed though tension become pure compression structures under their own weight and therefore highly desirable for concrete shells – concrete being a material strong in compression but weak in tension. Isler's proposals astounded the eminent audience to such an extent that they provoked a heated and extended discussion. His inflated membrane method led him to develop a standard "bubble" shell that was utilised in hundreds of examples up to 58.8 metres (193ft) in span, mainly for commercial and industrial buildings.

However, his reputation as a structural artist was earned primarily from the slender shells shaped by inverting the form of a hanging cloth or membrane. The elegance and structural purity of forms such as the two 31.6 metre (104ft) span triangular plan canopies of the filling station roof at Deitingen, near Bern, constructed in 1968, gained the respect and acclaim of architects as well as engineers. When, in 1999, their demolition and replacement with a standard steel canopy was threatened, a campaign for their retention was supported by eminent Swiss architects including Mario Botta, and the twin shells were retrieved.

Although steel had become the material of choice for medium-span roof structures in developed countries, Isler continued to build his reinforced concrete shells into the 1990s. In 1983, he received an honorary doctorate from the ETH and an honorary chair at Karlsruhe University, Germany. He is survived by his wife, Maria, for whom, after her stroke, he took on the role of devoted carer for the last few years of his life, and by a niece and nephew.

• Heinz Isler, engineer and shell builder, born 26 July 1926; died 20 June 2009