Ref. No. 021 MAY 2001

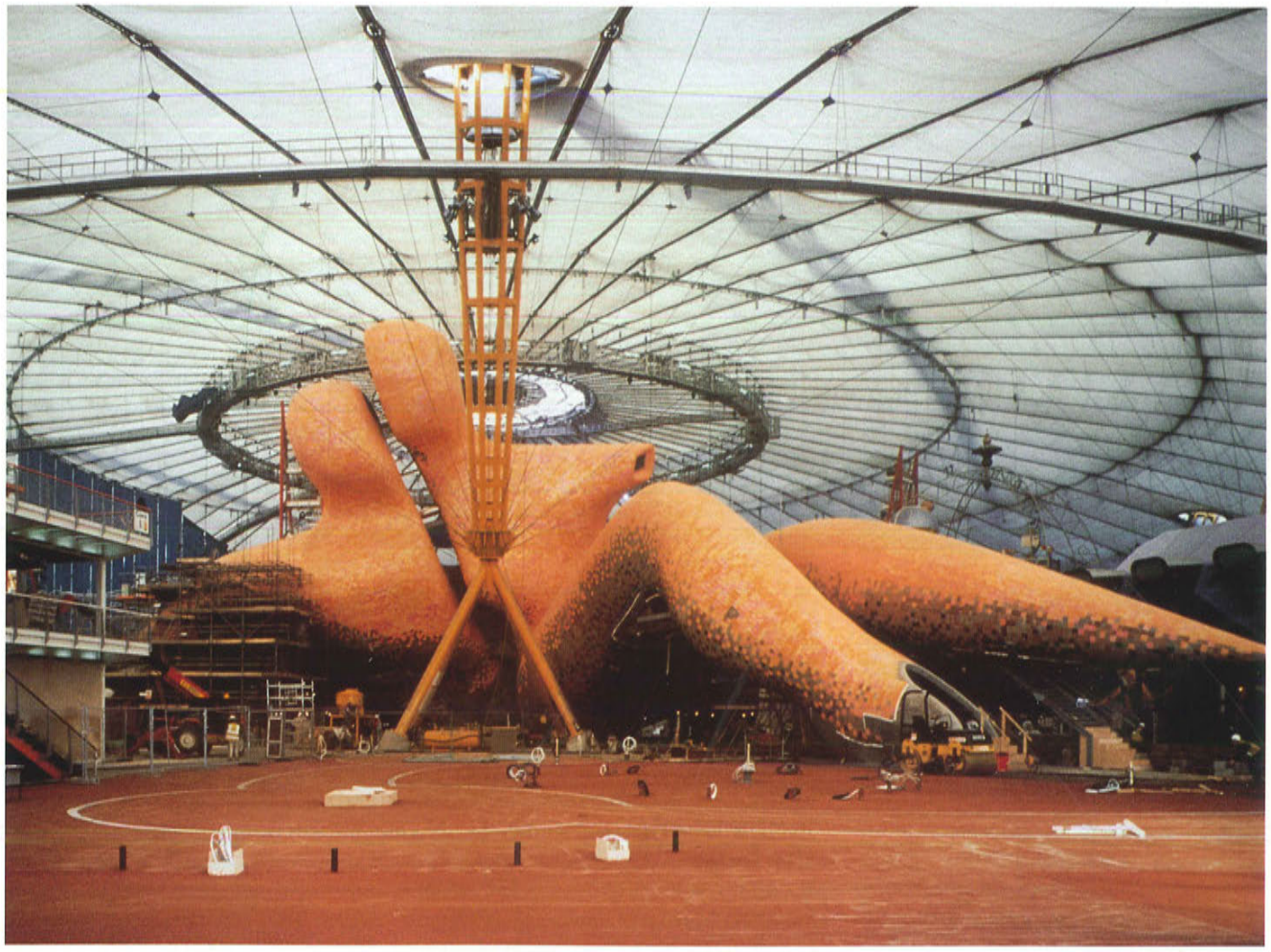
APPLICATION OF NEG ARG FIBRE

Nippon Electric Glass

NEG ARG Fibre, manufactured by Nippon Electric Glass Co., Ltd., is used throughout the world as a reinforcement for cement composites, including asbestos replacement products.

GRC Helps Showcase the Wonder of the Human Body

– Nine-story high male and female figures grace the Millennium Dome –



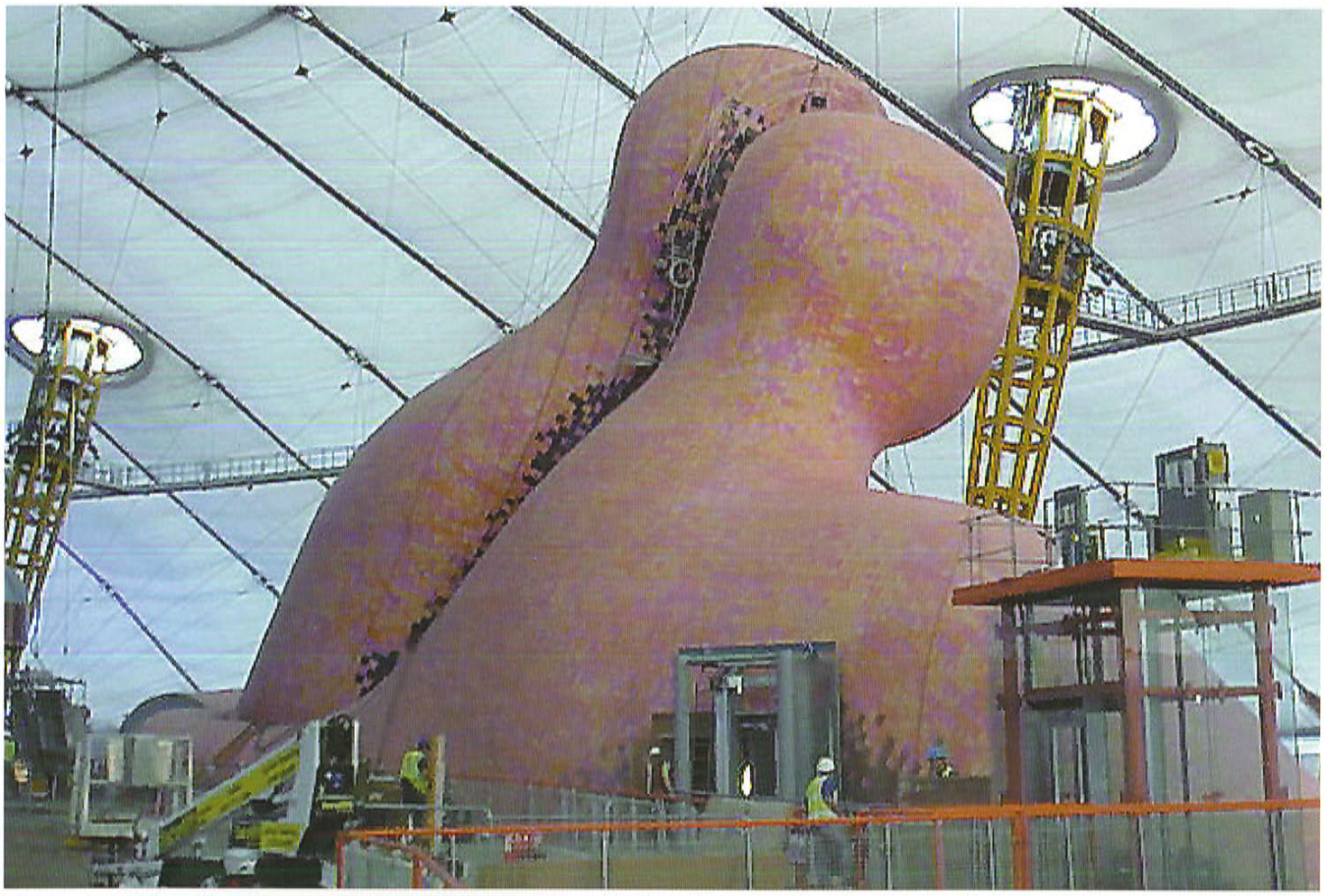
As much as the Millennium Dome in Greenwich, London was to be a celebration of man's progress, it was also being built as a dynamic monument to the potential of mankind in the new millennium. So it could hardly get along without a monument dedicated to the beauty and complexity of the human body. Plans for the one — actually two — got under way in 1998. Use of Glass Fibre Reinforced Concrete (GRC) for the Body's "skin" was proposed early on, but not quickly accepted.

GRC was not considered as a viable option until Glenn Industries' (Australia) Managing Director, Mr. Tony Grosset, presented to the New Millennium Experience Company (NMEC) their proprietary 3-dimensional construction technology to design and construct large monuments to exacting detail. Glenn Industries presented a bold argument: if we can't do it with GRC, it can't be done. GRC met all the building code requirements and architectural criteria. Glenn's technology provided NMEC with the actual internal dimensions which allowed them to design the exhibition within the structure whilst the Body's skin was under construction.

NMEC finally acquiesced also taking into account Glenn's considerable experience in building gigantic and often bizarre statues in Australia and Asia. A bold attitude, good technology and lots of experience are fine ingredients, but the participants soon learned that building the Body would also need large dollops of ingenuity and perspiration.

Body Zone at Millennium Dome

Location:	Greenwich, London
Design:	Doug Branson–Branson Coates
Main contractor:	McAlpine Laing Joint Venture
Manufacturer:	Glenn Industries Pty Ltd (Australia)
GRC skin area:	4,200m²
Completion:	November 1999



Inner trip

The Millennium Dome encloses an enormous span (1km around, nearly 50 metres high at the centre) consisting of a central arena surrounded by 14 zones related to different aspects of human activity. The Body Zone being the most prominent exhibit, rated the most intriguing by many, offers visitors an opportunity to explore the shape, structure, composition and workings of a fascinating machine of matchless intricacy—the human body. Here, reclining male and female figures embracing tenderly, first impress us with their tremendous size (the room could hold the Statue of Liberty placed sideways) and then with a sequence of amazing experiences as we pass through their bodies. Things that we all know go on inside ourselves but rarely stop to think about suddenly happen all around us with such immediacy and force that they take on new meaning. An enormous heart pumps, blood surges through arteries and veins, and muscles contract. As you enter the female's womb, spermatozoa swim past on the way to the egg... But no visitor should miss the chance to learn some important new things too, especially about how our lifestyles affect the way we look, feel and perform.

In the beginning was the laser

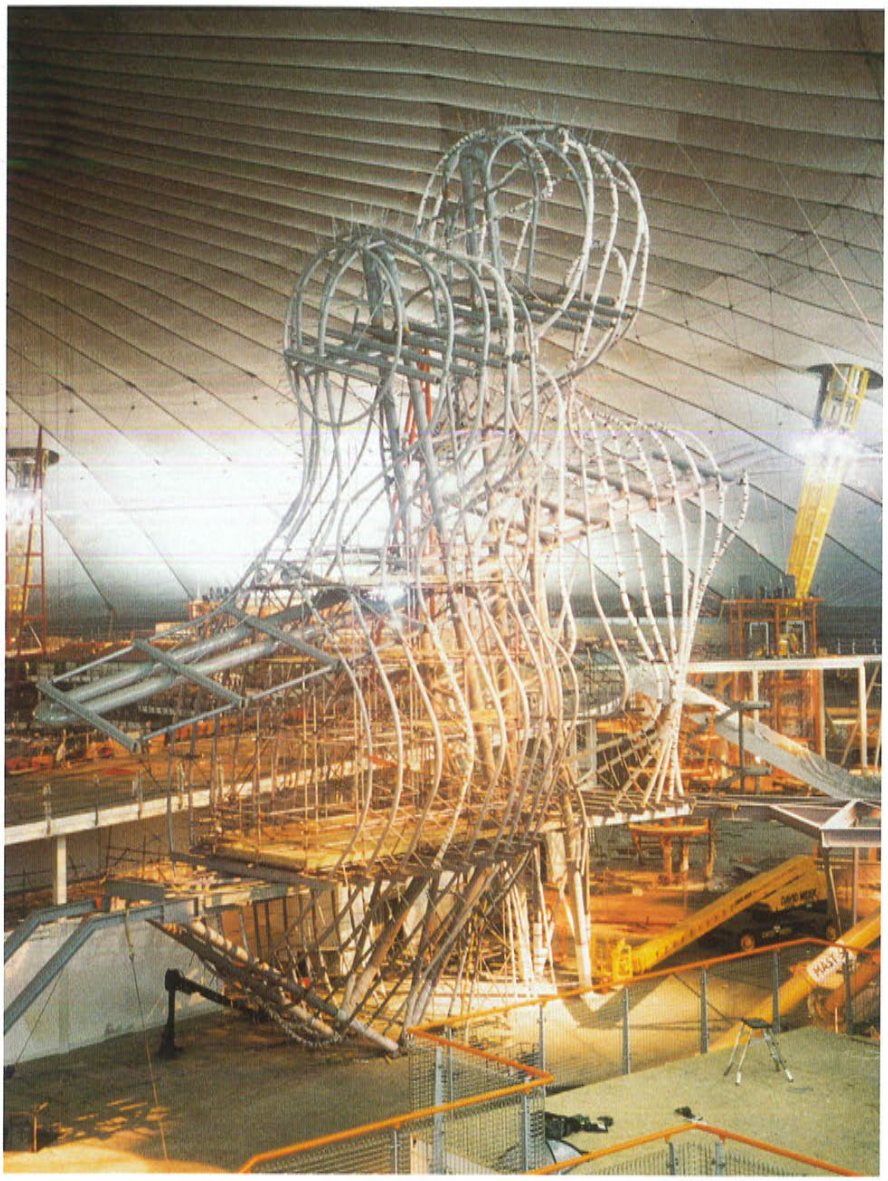
Modern architectural and construction methods were not developed with an eye to designing building structures that look like people. So creating the Body required a few innovations.

Glenn Industries using computerised 3-dimensional laser surveying technology developed a construction programme—Dots in Space (DIS) technology, which enables any model to be built to exacting detail at any scale.

The Architect, Mr. Doug Branson of Branson Coates (London), produced a 200:1 scale model of the human form in clay. This model was scanned with a laser beam to compile a file of hundreds of surface points co-ordinates.

Glenn actually produced six models at different scales, mostly to demonstrate the feasibility of the process. Then, at last minute, the Body was redesigned and another laser scan had to be conducted. With only very limited time to apply the GRC skin, that was a major setback.

Worker handsprays Glenn's unique cementious matrix and ARG fibre as a slurry on the Body's steel skeleton. A cutter incorporated in the sprayhead chops glass fibre rovings into chopped strands, which are then blended with the cement mortar just before it is sprayed from the nozzle. The completed GRC "skin" was later overlaid with 88,000 shimmering Lenticular Tiles.



Framework of the Body Zone.

Shaped to a T

Glenn's computer construction programme made one of the hardest jobs of building the structure to sit within the Body's skin relatively easy. In fact, Glenn's programme provided very accurate dimensioning allowing the interior exhibition to be built in parallel with the construction of the GRC skin. That technology provided time and cost savings.

The tubular sub frame on the structural steel frame provided the platform for visitors to walk on. Safety was also a constant concern because the Body had no level surfaces for workers to stand on. This made complex access-scaffolding necessary. The shape of the model surface was reproduced on the structure by another innovative process. Thousands of steel "bob bars" were welded to the sub frame prior to assembly at 40cm intervals, sticking out like bristling porcupines quills. Each bar was then cut to the length determined by the computer controlled 3-dimensional system. Accordingly, this provided the desired overall contour. Short cross-bars were welded to the tips of the "quills" making them look like T's of various heights. Another steel rod was welded at right angles to form an armature grid to which steel mesh was fastened. The result was a steel framework that matched the shape of the model and was ready to receive sprayed GRC skin.

From the start of the building of the structural frame through to the completion of the tubular sub-frame and the GRC skin including Lenticular Tiles, the huge torso took about six months to build. Offering an overview of human biology and advances in medicine to those passing through its GRC-enclosed interior, the Body was one of the Dome's most popular attractions.

The Body Zone, sponsored by Boots The Chemists, was built as a tribute to the wonders of the human body and the human race. Even though reclined, the golden forms of the stylised male and female figures reach a height of 27 metres.

The Millennium Dome, which closed on December 31, 2000, will go down as an end-of-the-millennium event that attracted much attention.

GRC and tiles do the rest

The sprayed GRC slurry, 310 tonnes in all, was a mixture of cement, specially treated silica sand, setting accelerator, alkaline-resistant NEG glass fibre chopped from rovings, and water. The chopped glass fibre was added to the other components at the sprayhead, together with water, at the rate of 3% by weight. Although the work progressed smoothly, the job of spraying the total area of 4,200m^2 to a thickness of 1.5cm still took three months. The spraying was done in "daily panels" of up to 200m^2 and each panel was manually smoothed to prepare it for the attachment of tiles.

As a safety measure, the structure was designed to withstand up to 15cm of movement as the skin was spayed on. Only 7cm was observed. The fibre content of the skin, an index of strength, was monitored throughout by analysing samples cut from the individual panels.

The finishing touch was to overlay the whole Body with undulating Lenticular Tiles that gave it a radiant luster varying in color from pink to gold depending on the viewing angle.

The Body was Glenn Industries' first project in Europe and the company hopes to parlay its success into additional contracts in the U.K. as well as on the Continent. Given the company's well-proven GRC know-how and the Body's resounding reception, prospects look good.

Nippon Electric Glass Co.,Ltd.

1-14, Miyahara 4-chome, Yodogawa-ku, Osaka 532-0003, Japan

2C MAY'01 Printed in Japan