

The Great Glasshouse

Wales Great Glasshouse reinvents the greenhouse for the 21st Century

The Great Glasshouse in the National Botanic Garden of Wales, now in full operation, reinvents the glasshouse for the 21st century. The design and engineering is a cooperative effort of longtime MicroStation® users Foster and Partners of London and Cirencester, UK, structural engineering firm Anthony Hunt Associates.

The Great Glasshouse is the largest single-span greenhouse in the world. It contains more than a thousand plant species—many endangered—and conserves specimens from Mediterranean climates around the globe. Set in hills overlooking the Tywi Valley in Carmarthenshire, the building forms the centerpiece of a 568-acre park. Its tilted, elliptical plan creates a toroidal form for the roof, measuring 99 x 55 meters, which swells from the ground like a glassy hillock, echoing the undulations of the surrounding landscape.

MicroStation was used from the early planning stages, allowing the team to generate and refine the complex geometry of the Glasshouse. All geometrical data relevant for the design and the construction of the building resided in a MicroStation 3D model.

“Geometrically complex buildings like the Great Glasshouse can only be designed and planned in the given time constraints and with the required precision if the computer is used as a design tool,” comments Iain Godwin, director of IT



Exterior view of Great Glasshouse with open glass panels.

SUMMARY

Organization

Foster and Partners

Vertical Market

Building

Location

Carmarthenshire, Wales

Project Objectives

- Rely on advanced modeling technology to generate complex geometry.
- Create a project model to serve as geometry database and setting-out instrument for all consultants, incorporating and coordinating all changes throughout the project.
- Use the single model to generate and issue primary construction documents, including 2D construction documents, when necessary.

Fast Facts

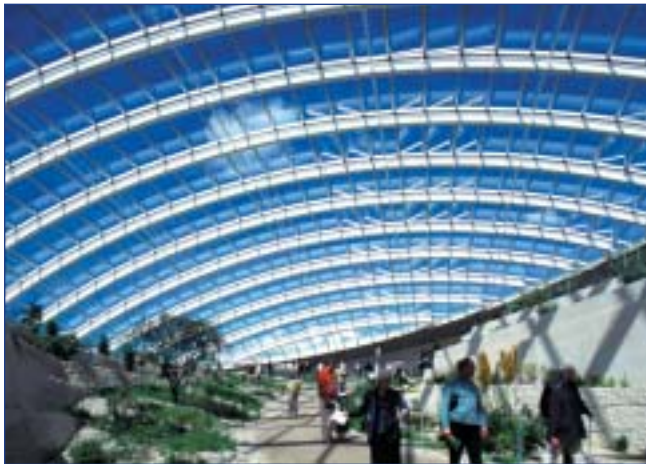
- The Great Greenhouse is the largest single-span greenhouse in the world. Its domed roof measures 99 x 55 meters.
- The use of MicroStation allowed the team to generate and refine the complex geometrical shapes needed for the greenhouse design and construction. All relevant geometrical data resided in a MicroStation 3D model.

Bentley Products Used

- MicroStation

at Foster and Partners. "The computer model developed for the Great Glasshouse proved to be of enormous value for the exchange and coordination of the geometry data of the building not only among the designers but also with the contractors during the construction process."

The computer model was the geometry database and the setting-out instrument for all consultants working on the design. Every change was coordinated and incorporated into the model. The updated model was regularly sent to the designing members of the team in electronic form. "CAD files provided the most compressed type of database for geometrical data and at the same time allowed for extracting of coordinates for a virtually indefinite number of points with very high precision," adds Godwin.



Interior view showing roof arches.



Interior view of Great Glasshouse.

The 3D CAD model was issued as construction information to the contractors, accompanied by a set of explanatory drawings. From this, contractors were able to develop their detailed design and fabrication information and to partially automate pre-fabrication with a high degree of precision in manufacture.

For some elements that were essentially 2D in their form and where the contractor may not have had computing capabilities, x,y,z coordinates were extracted from the model and were issued in drawing form. The prefabricated components and the site-constructed parts were then set out on site with the help of a high precision theodolite. The torus coordinate system was transformed into a building coordinate system, which itself is linked to the National Ordnance Survey Grid and fixed stations on the construction site.

An expanded version of this article, with more details on the construction process, is available at MSM Online.

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