



Butterfly Bridge

The Project

Unforgettable first impressions are not often associated with footbridges. With the help of Graitec UK's SuperSTRESS and SuperSTEEL, Jan Bobrowski and Partners have created a stunning footbridge across the River Great Ouse in Bedford. This remarkable structure combines aesthetics, functionality and engineering in an award-winning approach.

Known as the Butterfly Bridge, the eye-catching structure is the outcome of a Royal Institute of British Architects' competition run by Bedford Borough Council in 1995. Taking its cue from Webster's 1888 suspension bridge nearby, the goal was to design another bridge noteworthy of modern times.

Company Profile

The challenge was taken up by Wilkinson Eyre Architects who immediately sought advice from the internationally acclaimed consulting engineers Jan Bobrowski and Partners. Founded in 1962, the firm is known for its long span structures; examples include the Calgary Olympic Saddledome, the Gold Card Stand at Cheltenham Racecourse plus the South Quay and Bellmouth Bridges at Canary Wharf.

According to Partner John Cutlack, the firm has used Graitec UK's software for over a decade. Its core programs are the SuperSTRESS frame analysis suite, SuperSTEEL; for design to BS5950 and SuperMODEL for visualisation and presentation graphics.

The Design Concept

The first meeting between architects and engineers proved definitive as the rough idea of a simple leaf shape laid across the river was proposed. However, the engineers pointed out that the stiffness in a leaf was at its centre and suggested relocating this to the outside. More discussions resulted in an outline structure looking much like a butterfly.

To find the right engineering solution for this idea, the firm turned to its Graitec UK programs, SuperSTEEL and SuperSTRESS, to model the entire structure. The most important task was to determine the proportions of the arches - the butterfly's wings - in plan and elevation. The engineers proposed using parabolic arches, knowing this offered a flexible solution.



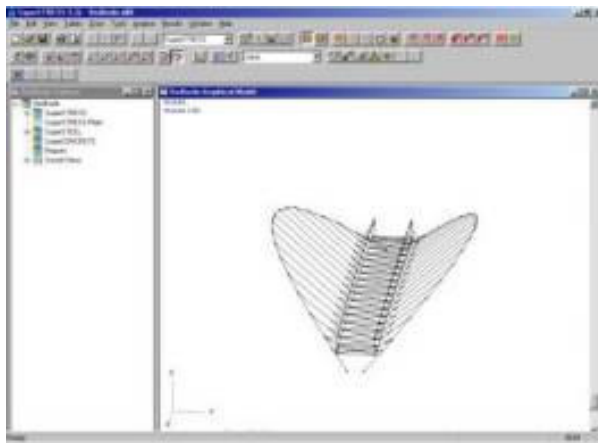
"The beauty of a parabola is that when you stretch it in any direction, it remains a parabola. We could do that easily using the stretch facility in SuperSTRESS," explains Cutlack.

Working alongside the architects for visual guidance, the right proportions for the arches were soon determined. This left only engineering issues centred around deflections and member sizes.

It was important to match the latter with the arch proportions as well as satisfying the overall visual appearance. If all this sounds time-consuming, it certainly wasn't in this case. Graitec UK's software allowed the design work to be done in under a week to everyone's mutual satisfaction.

"The key to winning the competition with this design was SuperSTRESS' graphical interface and ease of input. We could alter the bridge structure without having to resort to co-ordinate geometry. Elements were dragged and stretched for visual effect."

Having found the right proportions, the engineers then looked for any sensitive elements in the design and set parameters for any changes. Detailed analysis with the software included bending moments and the distribution of forces. For example, SuperSTRESS' useful tension-only member facility analysed the hangers between arch and deck.



Project Results

The Butterfly Bridge proved the winning design in a highly competitive field of 79 entries. More detailed work on the £375,000 project was carried out after the contract was awarded. This work included decisions on rod diameters, loading patterns, and BS5950 checking with SuperSTEEL. The complex geometries associated with embedding the supports into sculpted concrete abutments were also calculated. The 22-tonne 34-metre span structure with a three-metre wide deck was then erected in a single day.

Five years since the Butterfly Bridge was opened, Graitec UK's software continues to prove its worth. The seamless yet simple integration between SuperSTEEL and SuperSTRESS means designs can be refined swiftly with automatic cycling between the two user-friendly programs. For example, Cutlack says this tight integration has proved invaluable for large space frame grandstand roofs, where virtually every single member has to be designed and thanks to a powerful graphical interface, no design job ever seems too complex or challenging.

"Graitec UK is an industry leader. The software is developed in the knowledge of how an engineer actually works. When we call them for technical help, we talk to an engineer. The quality of that support with its instant response is very good too," concludes Cutlack.