LOTUS POND BRIDGE: A CASE STUDY IN COLLABORATION USING PARAMETRIC MODELING

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One of my tasks while working for Arup in Los Angeles was to teach engineers how to design and communicate using the same tools as architects. As increasing numbers of clients provided us with virtual massing and conceptual models to work from, my colleagues began to acknowledge the need to develop engineering solutions within these same virtual environments. So, my challenge was to not only utilize 3D modeling for visualization but also for design, analysis and production.

Koos Real Estate Development needed a 68m bridge designed for the entryway into an exclusive new housing development outside Taipei, Taiwan. The bridge was to span a shallow pond and provide for pedestrian and automotive traffic. Arup was commissioned to design and engineer the bridge and ultimately assist with the marketing and presentation materials for the design-build project. The Lotus Pond Bridge presented itself as the ideal project to implement parametric modeling because collaboration between designers, engineers, fabricators and contractors required seamless coordination and integration.

The bridge initially went through several design iterations within AutoCAD and 3Dstudio Max. Once the client approved the final form, the 3D model was imported into Lightscape where a lighting design was developed and verified. The rendering and photometric capabilities of Lightscape reassured the client that we were providing adequate lighting levels and allowed us to simulate the lighting effects of the specified fixtures. Simultaneously, a centerline drawing was exported into SAP 2000 for member sizing and load analysis. The same centerline model was then exported into a steel manufacturing program by the fabricator to produce all of the shop drawings, specifications and material lists. Employing this product ensured the client would get an accurate price and each steel member would be manufactured to exacting tolerances. A virtual phasing model and rudimentary animation was also produced in SAP 2000 to confirm the bridge would be self-supporting during construction and to accurately illustrate construction sequencing to the contractor. With language barriers and limited construction administration activities occurring from Los Angeles, all support information needed to be self-explanatory.

Advertising for the housing development needed to begin prior to construction, so we enlisted the processing power and animation skills of a local multi-media firm. Using SoftImage, they were able to merge our 3D bridge model with a site model and panoramic site photos to produce a photo-realistic animation for client distribution. In support of these promotional efforts, we produced a batch of models to distribute at the groundbreaking ceremony using rapid prototyping. From 3DStudio Max we exported a stereolithography model that was used to fabricate a fused deposition prototype. This prototype was used as the tool for a silicone die employed in the manufacture of 50 injection molded, ABS plastic replicas of the bridge. These models along with the animation videos were handed out to potential investors, local politicians and VIP’s at the groundbreaking ceremony.

Parametric modeling was critical to the success of the Lotus Pond Bridge project and is the way of the future for architecture. While complex, high-profile projects such as Gehry’s Experience Music Project and Walt Disney Concert Hall require the use of CATIA and X-Steel as an integral part of the design process, architects need to recognize that parametric modeling should be used consistently regardless of project complexity and scale. Traditional, small-scale projects can benefit the most from shorter turn-around times and an integrated revision process. With entire project teams working within the same environment, discipline integration and collaboration leads to fewer change orders, seamless coordination and a more accurate and efficient design process.

Stephanie Jaeger currently works for Gensler in Santa Monica, California. Her research interests focus on the application of new materials and manufacturing methods within the realm of architecture.