Shape and Strength: Load Bearing Digital Geometries

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EXECUTIVE SUMMARY

As 3d computer modeling technologies become firmly entrenched in the generating of architectural form, they have increasingly been used as purely aesthetic tools. While digital formmaking and spacemaking investigations are decidedly worthy architectural pursuits, they have typically come at the cost of little attention being paid to the creation of forms that are merely able to support themselves. This shift toward aesthetic over structural has missed several significant opportunities that digital tools could offer. As the field of architecture turns toward a paradigm of sustainability, the efficient use of material resources becomes of prime importance. The discovery of new structural shapes, and the means and methods of constructing them, could offer not only an advantage in materials efficiency, but a whole new accompanying aesthetic palate for the field of architecture to explore as well.

This research undertaken with funding from the BSA has focused on investigating structural shapes that can be generated and fabricated with digital tools, the translation of those shapes to real-world physical constructions, and noting aesthetic patterns that might emerge. This project consisted of five phases:

Phase I A thorough survey of historical methods of finding structural shapes.

Phase II Constructing shapes through digital means.

Phase III Creating a system to classify shape families.

Phase IV Testing and comparing shapes using Finite Element Analysis software.

Phase V Further refinement of the most successful shape for better performance.

Coincident with phases I-IV was extensive construction of physical models. The culmination of these physical models will be the construction of a single structure that is large enough to be inhabited and experienced spatially. This “model” is currently in the beginning stage of CNC parts fabrication and is scheduled for completion during spring 2007.