NATIONAL WINNER

$25M OR GREATER, BUT LESS THAN $100M

Peter B. Lewis Building
Case Western Reserve University
CLEVELAND, OH

STRUCTURAL ENGINEER
DeSimone Consulting Engineers, P.L.L.C., San Francisco, CA

ARCHITECT
Gehry Partners, LLP
Santa Monica, CA

CONSTRUCTION MANAGER
Hunt Construction Group
Indianapolis, IN

SOFTWARE
CATIA, RISA 3D, SAP 2000

The Peter B. Lewis Campus of the Weatherhead School of Management is the latest addition to the campus of Case Western Reserve University in Cleveland, OH. Peter B. Lewis, Cleveland entrepreneur and resident, agreed to supply major funding to the project if world-renowned architect Frank O. Gehry of Santa Monica, CA, would design it. Design began in 1997, ground was broken in April 1999, and construction completed in 2002.

The building encloses approximately 145,000 sq. ft. and rises 110′ at its highest point. It will provide offices for the school's professors and graduate students, a library and cafeteria, as well as several state of the art classrooms.

Metal-clad, cloud-like shapes that form portions of the building's roof and walls are characteristic of Mr. Gehry's most recent works. Those shapes, comprising the most noteworthy areas of the building exterior, are framed with structural steel. An underlying cast-in-place concrete structure in turn supports the steel members.

A large atrium space is contained within the building. Covered with over 50,000 sq. ft. of curving drywall, the walls of the atrium define a magnificent space that will provide an inspirational space for future students and faculty of the Weatherhead School.

At a first glance, the Peter B. Lewis Building may look quite like other Frank Gehry projects as portions of the structure are covered with curving, stainless steel clad surfaces. However, a deeper investigation reveals that not only are these surfaces much more wildly undulating than any of Mr. Gehry's previously completed projects, but the structural steel support structure for these surfaces required the design of two unique and never before used structural systems. The design and construction team referred to these systems as "ladder trusses" and the "stick and pipe" system.

The name "ladder truss" was given to structural members constructed by bending 4" diameter pipes to form interior and exterior chords and welding staggered flat plates to each side of the pipes. The resulting member is a type of Vierendeel truss.

The second structural system, the "stick and pipe" system, is comprised of straight structural HSS, varying in size from HSS8×4s to HSS20×12s, and crossed with 4" diameter pipes bent in 2D to conform to and define the design surfaces.

The desire for a structure covered with pipes arose during schematic design as DeSimone Consulting Engineers and Gehry Partners began to coordinate and prepare documents for the construction of the building. It was decided that a new approach for a Gehry project would be attempted in which the structural steel would completely define the geometry for the steel clad surfaces of the building. In previous Gehry projects the main structural steel system was used either (1) to approximate the design geometry, requiring the use of a secondary system that had to be completely adjusted in the field, or (2) to define the design geometry only at regularly spaced intervals, typically by way of "ribs". This system required the use of specially shaped panels, which finished the definition of the design geometry between rib locations.

Using the computer program CATIA, the design team insured that a

JUROR COMMENT:

Challenging geometry problems—solved beautifully with steel.

4" pipe was placed no more than 6' apart on each design surface. The pipes were placed in specific locations: perpendicular to "ruled lines," straight lines found on any surface clad with pieces of flat material. (Surfaces without ruled lines, like a sphere, cannot be clad with flat materials). This arrangement allowed the steel pipes to be covered with straight, light gage metal "hat" channels spanning from pipe to pipe along the ruled lines. Since the pieces providing attachment point for the hats were always round pipes, the orientation of the channel to the pipe was not of concern. The "hats" were then covered with flat sheets of light gage metal, a layer of waterproofing and the signature stainless steel shingles.

Implementation of the new structural steel framing systems thus allowed the delivery to the jobsite of a structure that completely defined the curving design surfaces, minimized the need for field adjustment and could be clad with simple materials.

The final structure includes approximately 370 tons of structural steel. Each piece of the two miles of 4" diameter standard pipe was bent to form the direct support for the design surface geometry; no two pieces of pipe are alike, and not one is curved to a single radius.

Contributing significantly to the success of the project was a magnificent level of teamwork between the design and construction teams. Numerous meetings were held with all members of both teams to discuss the layout and location of structural members, connection details, detailing, review of shop drawings, and fabrication and erection concerns.

Further, while shop drawings were eventually produced and reviewed in the traditional manner, the most productive communication between the structural engineers and the fabricators took place electronically. Shop fabrication model files, for the first time produced using CATIA, including all tubes, pipes, plates, bolt holes, and other connection materials as 3D solids, were sent from the fabricator to the structural engineer for review and comments. Comments were made electronically by attaching pieces of text to the 3D element where the comment was applicable. After several rounds of this communication, the shop drawings were produced and reviewed by the engineers along side the final "shop models" on a computer screen, thus accelerating the shop drawings approval process.

From the outset, the design and construction teams realized that the Peter B. Lewis building would require the construction of curving surfaces wild even by the standards of a Frank Gehry project. The construction of these surfaces was completed successfully by opening channels of communication between all parties on the design and construction teams, utilizing communication and detailing review methods never before attempted, and the implementation of innovative and new structural framing solutions made possible only through the use of structural steel.