

Designing Monumental Staircase Structures

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Introduction

The office of Cowen Associates has been involved in the design of free standing stair systems for 26 years. It represents approximately 10 % of our business. Our clients are leading stair manufacturers in the Northeast. The structural materials used include wood, steel, cast aluminum, glass and Plexiglas.

This segment of the building construction industry is quite unique.

- The geometry of these stairs is often helical and represents a technical challenge.
- The diversity of the materials used also adds to the need for technical innovation.
- The structure becomes sculpture.
- Finally, the required interaction with various other Structural Engineers, Architects, Interior Designers and Owners leaves never a dull moment.

This article is designed to share some of our experiences in a specialty that is little known and rarely understood within the building design community.

We all know that everything that structural engineers do is unique and exciting. However, it is not always just about unique and exciting buildings and bridges. Structural engineers are involved in researching, designing and constructing all sorts of unusual masterpieces. The following describes one of those "out of the box" experiences.

Everybody Knows Stairs

For decades, Architects have put stairs in a "non-structural" category called "Miscellaneous Metals" or "Metal Fabrications." Specifications for these items often call for the Miscellaneous Metals fabricators to design and build the stairs, and require that the manufacturer provide some sort of Structural Engineering to document the stair's Code compliance.

This trend, now a historic fact, has led Architects to the conclusion that "all stairs are equal". Consequently, we rarely see monumental stairs specified separately. In addition, we rarely see stairs designed by the Structural Engineer of Record (SER).

Everybody Doesn't Know Monumental Stairs

Specialty stair manufacturers share a market of as much as \$100M per year in this country. These are manufacturers that delve into the "Decorative Stair" market, as opposed to the "Exitway Stair" market. There are big ones and little ones.

Shops without engineering help

Some small and medium sized manufacturers specialize in stairs for homes. They are usually wood fabricators or metal fabricators who are never called upon to supply engineering information or design, because building officials rarely require that level of documentation for single family homes. Wood fabrications of this type are often simple structures, and can be manufactured and installed without formal Structural Design. Some of these smaller shops have begun to innovate by using helixes and other more exotic geometry. Their methodology, again, is to build without the aid of Structural Engineering.

These smaller shops may get projects in office buildings or other facilities where the Structural Engineer of Record (SER) must be sure that the stair meets Code.

This is where the manufacturer must find an engineer to represent him:

- We have seen many circumstances like this, where manufacturers find themselves with a lawsuit because of non-compliance with the Code.
- We have seen circumstances where the manufacturer could not find an engineer with experience in the specialty, and was forced to pay an unreasonable fee.
- And finally, we have seen situations where manufacturers have had to redesign the stair or rails to conform to Code (sometimes without the extra compensation required)

Shops with engineering help

Medium and large manufacturers who regularly market and build stairs for office, commercial and institutional construction often contract out the Engineering to consulting firms such as ours. Most of these manufacturers market their products in many states, and some sell internationally.

The scope of Engineering required by these shops varies, and may include:

- Product development.
- Materials testing programs.
- Pre-sale development of stair support reactions.
- Checking for Code compliance of an architectural design.
- Stair system analysis and design.
- Interaction with the Architect and SER.
- Catalogs of engineering data.



A Monumental Stair by Atlantic Designworks, Newburyport, MA



A Monumental Stair by STAIRDESIGN, Inc., Newburyport, MA

Summary

The monumental stair system, like many proprietary systems, is designed by the manufacturer and approved and supported on the building structure by the SER. To achieve this, the manufacturer must have a structural engineer who can participate in the design process by cooperating and working with other Structural Engineers, Architects, Interior Designers and Owners.

Fred V. Cowen is the Chairman of the NCSEA Standing Committee on Structural Certification. Mr. Cowen is licensed in 14 States. Fred is President of Cowen Associates, Consulting Structural Engineers, Natick, MA. He is past President of Boston Association of Structural Engineers (BASE).

The Design Process

The initial design and purchase process begins with many different scenarios, including:

- A classic Architectural Design where there is an Architect of Record (AOR) and an SER on board in an ongoing construction project.
 - Where the manufacturer is working for the owner.
 - Where the manufacturer is working for the Contractor.
- A classic Interior Design where there is an attendant fit-up in an existing building with a local SER for the renovation.
 - Where the manufacturer is working for the Owner.
 - Where the manufacturer is working for the Contractor.
 - Where the manufacturer is working for the tenant.
- A non-classic design in an undocumented building with no local SER.

The manufacturer and its engineer must work their way through the process by firmly limiting both the scope of work and their liability.

For a successful project, the client and the manufacturer must both share important responsibilities:

- The client must obtain the cooperation of the Architect or designer to design a Code compliant stair and rail system.
- The manufacturer must develop a structural model of the stair that is compatible with the building structure and provide reactions for the SER.
- The client must obtain the cooperation of the SER to be sure that the building structure can support the stair.
- The manufacturer and its engineer must work with the client's people toward these mutual goals.

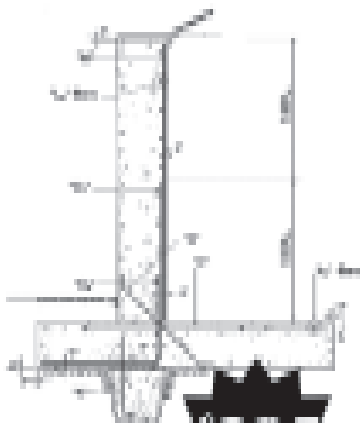
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