



Retrofitting the Curtain Wall

This renewal project converted an uninviting, non-code compliant, energy hog of a building into a highly desirable office building.

By Charles Enos, AIA, LEED AP
October 03, 2011

 Retrofitting the Curtain Wall 1

The William S. Moorhead building is a federal office building owned and operated by the General Services Administration (GSA). Located in downtown Pittsburgh, the building was built in the 1960s by GSA, who continues to manage and operate the facility. As is common with GSA-owned office buildings, GSA leases tenant spaces to other federal government agencies.

With its simple and clean exterior lines — using what were then state-of-the-art curtain wall systems — Moorhead is a prime example of the 1960s office building typology. However, these fifty-year-old curtain wall systems were not designed during an era of energy awareness and therefore do not stand up well to today's energy standards. Furthermore, like so many buildings of its era, Moorhead had outdated building systems, wasted energy and was perceived as an unpleasant place to work by federal employees.

Under GSA's Design Excellence Program, EYP Architecture & Engineering was selected as designers for the modernization of the Moorhead building. Constructed in 1962, the 25-story building consists of approximately 768,000 gross square feet, housing more than 50 different government agencies, each with different requirements for space, security and function. All building equipment and systems were original and had not been significantly upgraded since construction.

Modernization Goals and Objectives

GSA's vision for the project was the complete renewal of the entire building. The modernization scope of the Moorhead building established the following goals and objectives:

- Provide a new energy-efficient thermal building envelope
- Replace out-dated and inefficient building systems — HVAC, electrical, plumbing, water distribution, life safety — and provide a safe, energy-efficient, and technologically advanced building
- Create a desirable, comfortable, and aesthetically appealing work environment for tenants by transforming office space from Class B to Class A
- Bring the building into compliance with current codes, regulations and GSA guidelines governing energy efficiency, fire safety, handicapped accessibility, hazardous materials, etc.
- Keep all government agencies operational during construction and provide the most cost-efficient plan for phasing the renovations while minimizing tenant moves and disruptions, yet maximizing in-house swing space to maintain rent
- Remove all asbestos-containing materials
- Install a new state-of-the-art building control system
- Meet or exceed build green and sustainable design initiatives

Curtain Wall/Building Envelope

While many design solutions and sustainable design features were incorporated in the modernization of the Moorhead Federal Building, this article focuses on EYP's unique design solution for upgrading the thermal properties of the curtain wall system that makes up the vast majority of the building envelope.

As is the case with most 1960s office buildings, the existing building envelope was thermally inefficient. In fact, not only was the original curtain wall system not air-tight, but building users could actually feel cold air infiltration during winter as well as feel heat gain on the sun-exposed sides. Energy was literally going "out the window."

The curtain wall system encompasses approximately 80 percent of the building envelope with the remaining 20 percent being clad with dimensioned granite panels at the building core elements (which were re-pointed as well). The vertical spanning curtain wall system extends from the second floor to the top of the building and consists of 2'-7" wide panels alternating with 2'-3" wide glazing and spandrel panels. The original glazing is 1/4-inch vision glass and panels and spandrel panels are 1 1/2-inch insulated metal panels. One can clearly see that the poor insulation value of these wall and

window materials permit high infiltration rates and high thermal losses, resulting in excessive energy costs and an uncomfortable work environment.

Curtain Wall Retrofit

EYP explored the possibility of replacing the entire curtain wall system with a modern energy-efficient system, but it would have far exceeded the budget. The firm therefore worked in conjunction with CDC Curtain Wall Design Consultants to develop the following innovative solutions to achieve energy savings, improve user comfort and avoid the expense of replacing the curtain wall:

- Provide new 1/4-inch tempered low “E” glass storm panels installed inside the existing window via a magnetic track, creating a two-inch air space to help retain and regulate the indoor environment
- Install an adjustable blind between the existing and new windows to regulate temperature and light fluctuations
- Supplement the existing exterior curtain wall panels and spandrel panels with an additional four inches of batt insulation with an R-value of 14
- Reseal the glass and aluminum facade with silicone sealant and preformed extruded silicone elastomeric tape

All this work was performed from inside the building without removing any exterior portions of the curtain wall system, thereby maintaining the weatherproof environment for the construction and realizing great cost savings by not having to use exterior access.

With this upgraded building envelope and improved curtain-wall performance, the U-value of the windows decreased from 1.04 to 0.43 (the lower the U-value, the better its insulating value) and air infiltration decreased dramatically from 0.8 cfm/sf to 0.15 cfm/sf.

Project Success Summary/Benefits to Owner

By insulating the building envelope and installing a modern mechanical system with heat recovery to temper the outdoor air, the use of steam was reduced by 38 percent over pre-renovation numbers. Within the first year of system operation, GSA has already realized an average savings of 28 percent over pre-renovation energy consumption. These remarkable results are a direct result of insulating and sealing the existing curtain wall in conjunction with completely modernizing the mechanical and electrical systems.

GSA recently completed a tenant satisfaction survey for the building, and the results are indicative of the positive impacts a renovation can have on tenant environment.

As a result of the combined efforts of the design and construction team and GSA’s commitment to the project, the Moorhead Federal Office Building has realized the following results:

- New fully functional, versatile and aesthetically pleasing spaces designed to meet the specific needs of each government agency tenant
- Vastly improved ventilation and quality of indoor air

- Significantly improved thermal building envelope
- A cohesive overall building aesthetic
- Inviting entrances to every floor
- Increased daylighting in the work environment
- New energy-efficient HVAC, lighting, electrical, fire and life-safety systems
- New restrooms with state-of-the-art water-saving fixtures
- Satisfied government agency tenants
- Desirable and rentable space: GSA has a full building with no tenant vacancies
- Proven energy savings
- Award-winning design and construction

According to Bruce Lazar, GSA Moorhead Building Manager: “Our tenant satisfaction surveys have confirmed what we’ve been hearing by word of mouth — that the public servants who work in this building are more comfortable and more productive as a result of this renovation. The quality of the air circulation, the consistency of the indoor temperatures from season to season and the significant reduction in energy bills that we are seeing — all point to this being truly a high-performance building. We are very happy with the results of the modernization.”

GSA is now using the Moorhead project as a case study in the right way to do sustainable modernization. This renewal project converted an uninviting, non-code compliant, age-weary, energy hog of a building into a highly desirable and rentable Class A office building that provides a safe, healthy, inviting, energy-efficient and comfortable work environment.

Charles Enos, AIA, LEED AP, is a principal at EYP Architecture & Engineering, a full-service architecture and engineering firm with offices in Albany, New York City, Boston, Orlando, Greenville, and Washington DC. For more information visit www.eypaedesign.com, or contact Enos at cenos@ypae.com.