

Façades

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Double Skin Façades' Evolution and Return to the US: Two Architects Weigh In

Craig McIlhenny, Associate Partner at Ennead Architects, and John Pachuta, Partner at R. A. Heintges & Associates, will present three double skin facade case studies at the upcoming Façades Design and Delivery 2012 Summit in New York City.

In this Q&A Interview with Construction IQ, each of them weigh in on the evolution of the double skin façade, factors one must consider when choosing this type of system, and whether double skin façades constructed in the US have proven to be a cost effective solution to the building envelope.

Construction IQ: How do you determine the effectiveness of double skin façade?

Craig McIlhenny, Ennead Architects:

During the design phases, energy analysis can also be done to determine the effectiveness of a double façade in terms of reducing cooling loads in the summer, reducing heat loss in winter, and increasing occupant thermal comfort. The feedback from the model, typically in the form of annual energy savings, can inform the design further and help the project team to make critical decisions relative to the construction budget.

John Pachuta, R. A. Heintges & Associates:

During the initial phase of development, aspects of the façade system are studied in order to integrate design and performance requirements. This typically includes thermal heat transfer modeling, cfd analysis, and shading / daylighting studies. Performance targets are determined and incorporated into the project documents. Prior to fabrication of the system, laboratory testing of prototypes is conducted to provide confirmation that the contractor's system will meet the target values. This is followed by a program of field testing during installation as a quality control check. Testing typically includes standard tests for air and water infiltration, condensation resistance, structural loading as well as specialized testing such as acoustical performance and daylight illumination levels. All operable components in the assembly should be included in the testing program along with hvac components if the cavity space is mechanically ventilated / conditioned.

Construction IQ: How has double skin technology evolved?

Craig McIlhenny, Ennead Architects:

It is interesting to look at the evolution of window technology over the past 100 plus years to appreciate the development of façade glazing technology. 19th century European residential construction utilized box-type windows consisting of an inner operable casement window and outer layer of removable glazing. This system can be opened up in the summer time and sealed in the winter to optimize thermal and ventilation benefits. This “thermal buffer” concept is still used today in modern constructions of double-skin curtain walls.

Developments in the use of metal and glass for facades in the mid and late 19th century (e.g. greenhouse construction, Crystal Palace, etc.), and the early 20th century modernist concept of a skeletal frame in which the building cladding no longer had any load-bearing function, opened up limitless possibilities in enclosure design. While this was a positive development in terms of design, there still remained limited glazing solutions which left large areas of glazing with poor thermal qualities and increased solar gain.

In the 1950's, the double-glazed window was developed, coupling two glass sheets separated by a small air space. In the 1970's, the casement frames holding double-glazed glass units were thermally divided with plastic “thermal breaks” - further improving thermal comfort and performance. The 1960's and 1970's saw the development of glass coating technology to reflect solar heat (infrared energy) from the glass surface before it entered the building. However, many of these coatings were aesthetically undesirable - mirror-like in appearance or tinted. The 1990's saw breakthrough technologies which brought neutral colored coatings offering both a high degree of light transmittance and low solar transmission.

While coating technologies continue to evolve, modern double-skin façade systems which employ the latest glazing technologies can achieve a higher level of performance and quality through a coordinated combination of simple construction components. Specifically, these facades offer a quality of variability through the careful use of natural ventilation, shading elements, and inherent thermal characteristics.

John Pachuta, R. A. Heintges & Associates:

The first modern double skin façade in the world was constructed in 1980 at the Hooker Office Building in Niagara Falls, NY, by Cannon Architects. Over the following 30 years, there has been significant progress in double skin façade design and construction realized through its widespread use in Europe. This technology is now finding its way back to the United States. As architects and building owners look for ways to reduce energy consumption while enhancing the user experience in their buildings.

In addition double skin façade systems are being utilized in projects throughout the world in a variety of climates. New methods of analysis and testing are helping to further optimize the performance of double skin facade systems while more widespread use will continue to reduce fabrication and installation costs.

Construction IQ: How does the functionality of the building determine the type of double skin façade?

Craig McIlhenny, Ennead Architects:

Climate and orientation are paramount to the selection of any façade system. As you will see in some of the case studies to be discussed in our presentation, another factor that comes into play, one that is linked to the building's function or program, is cost of the façade relative to the overall building budget. We often find that when the façade cost is only a small percentage of the total building cost, there is a much stronger case to be made for incorporating a technologically advanced façade in the design. Double skin facades do, at a minimum, cost twice as much as single skin façades, and paybacks are not always compelling to building owners. That said, the aesthetic appeal of double facades can also be a positive factor for clients who appreciate the expression of cutting edge technology and recognize that it can elevate the stature of their institution or intellectual community.

John Pachuta, R. A. Heintges & Associates:

Building type, along with climate and orientation, plays a major role in the design of the double skin facade. Usage patterns, space programming and heating and cooling requirements must be taken into account when detailing the wall. Office, laboratory and residential buildings will each have different requirements. The double skin facade will have the greatest impact on the interior environment of the perimeter zone. Therefore, the spatial configuration, whether open plan, enclosed offices or multi-story atrium will inform the selection of natural vs. mechanically ventilated cavity as well as strategies for compartmentalization and air flow. Lighting requirements and access for operation and maintenance will also be determining factors in the choice of system type.

Construction IQ: You will present three Facades case studies you have worked on at the upcoming conference: Weill Cornell Medical Research Building, University of Michigan Biomedical Science Research Building, and Riverhouse Residential Tower. Can you give us a preview of one of the case studies?

Craig McIlhenny, Ennead Architects:

The University of Michigan Research Building is an example of a true double-skin façade, one which encloses the office portion of a 472,000 sf laboratory facility. It is a south-facing wall that incorporates a wide interstitial air cavity for maximum thermal and solar benefit. The cavity is completely closed in the winter, capturing the heat during the day and insulating the

office space at night. In the summer, the cavity is freely ventilated to help reduce solar heat gain to the interior and reject this heat through the top vent in the cavity. In both summer and winter, the cavity reduces the temperature delta on the glass wall of the office, reducing the energy load of that portion of the building. The curtain wall also offers an effective acoustical buffer from the nearby busy street.

Construction IQ: When considering initial cost vs. long term energy savings, have double skin facades constructed in the US proven to be cost effective solutions to the building envelope?

Craig McIlhenny, Ennead Architects:

The payback period in the U.S. for double-skin walls is not significant yet. Nevertheless, given the anticipated rising (and presently high) energy costs, the construction of double facades as a cost effective solution to the building envelope has becoming more and more compelling. It should be noted that cost is not the only factor in the U.S. The appreciation for sustainability and energy conscious buildings is rising and clients are willing to consider enhanced systems for reasons other than reducing cost.

John Pachuta, R. A. Heintges & Associates:

There are many types of systems that can be classified as double skin facades, with varying costs relative to conventional envelope construction. In the Riverhouse project, a double skin box window type system was developed to increase the percentage of vision glass along the west elevation beyond the prescribed requirements of the Battery Park City Authority while maintaining a comparable u-value to the standard window / masonry wall assembly. This allowed for increased daylighting and river views for the apartments along with providing an integral sun shading device and shielded vents for natural ventilation.

In Europe, there is a consensus that providing natural ventilation in the exterior envelope will increase human comfort while decreasing the energy required to heat and cool perimeter spaces, particularly during spring and fall seasons. Based on current energy costs in the United States, a double skin façade system may or may not yield a significant return on investment on its own, however in combination with other energy reduction strategies it can provide an effective means for enhancing both the envelope performance and the user experience through greater control and modulation of the exterior enclosure.

Craig McIlhenny and John Pachuta will be speaking in-depth on this topic at the upcoming IQPC Facades Design and Delivery 2012 Summit in New York City, January 23 to 25, 2012. For more information or to register, visit www.facadedesignanddelivery.com or email info@iqpc.com.