Consider Optimizing Your Gains while Undergoing the Pain of Building Envelope Renewals

Nobody likes spending large sums of money on their assets when one or more building envelope assemblies have reached the end of their service life. Yet, major renewals are inevitable for long-term building assets.

Minimal intervention is often tempting to minimize the immediate financial pain when faced with the burden of an expensive renewal project. However, the outcome is likely predictable based on how well the components have aged, occupant surveys, and past utility bills.

If there are no issues or concerns related to the existing assemblies; components can be replaced with like or the modern equivalent. However, if the assembly or components need replacement sooner than expected, operating costs seem high, and there are comfort issues then renewal time is likely a good time to upgrade. The incremental costs should pay for themselves over the life of the renewed assembly.

This article discusses how challenging the status quo for building envelope renewals and how exploring the opportunities to improve performance can provide financial dividends to long-term owners and operators of large buildings.

Recognizing Opportunities to Optimize Gains

The motivation for upgrades can be to lower operating costs, create more comfortable environments, increase rents or re-sale values, reduce maintenance, and/or have longer lasting assemblies. All these factors can contribute to future financial gains, but there are also intangible benefits such as better work or home environments.

Major renewals of large buildings require professionals to oversee the work and the stakes are often raised by high costs and many stakeholders. Nevertheless, some upgrades can be done without risk when there are no expectations for return on investment. Simply renew with best practice high performance assemblies and make sure there are no implications to other building systems, such as heating and ventilation systems. If there are, then upgrade those systems too. However, testing and analysis can help make more informed decisions by quantifying options and prioritizing upgrades so that owners can get the most out of renewals.

Photos 1Glazing retrofit of window-wall where only the slab by-pass was renewed

For example, a common dilemma is what to do with aging glazing that has issues related to leaks, condensation, uncomfortable indoor conditions, and noise. Owners want to know how much they will save on their utility bills. There are many renewal strategies to address aging glazing and upgrades to the heating and ventilation systems is necessary when condensation and indoor comfort are a concern. Testing and monitoring of existing conditions helps to identify feasible solutions, while computer simulations can help quantify the benefits.

Quantifying the Potential Gains

Many decisions guided by testing and analysis are focussed on the risks, but what about the rewards? Risks can typically be managed by applying sound engineering judgement and experience, but determining optimized gains takes more insight.

An experienced engineer will intuitively know what makes practical sense and will be able to guide decisions but simulations is necessary to quantify the benefits. Testing, monitoring, surveys, and utility bills are also often valuable to help focus and confirm assumptions.

Some individuals may conjure up visions of an inexperienced young university graduate playing "Nintendo engineering" when computer modeling is mentioned in the same sentence as necessary. However, the dated gaming reference might give a clue to the era where that thought originates.

Photo 21Investigation for a feasibility Study focused on evaluating the risks and benefits of insulating a brick masonry wall

Larger engineering firms focussed on building science have evolved in the past decade and are equipped with analysis tools that were once only useful to researchers and designers of space shuttles. Now it is possible to evaluate hundreds of simulations and present in a time-frame and format that is beneficial to the design process.

For example, many individuals focus on the risks of insulating an old brick masonry wall. Theory tells them that adding insulation inboard the brick will reduce the heat flow, reduce drying, and increase the risk of freeze-thaw damage. Therefore, design questions are often focussed on safe insulation levels. However, the optimum insulation levels are likely more dependent on energy efficiency and thermal comfort. Modeling can help determine insulation levels that provide the most bang for your buck, while taking into account realities such as thermal bridging (at interfaces to windows, floors, and parapets), climate, and occupancy.

Making Decisions and Embracing Uncertainty

Building science generally does not adhere to a black and white reality. Often there is a lot of maybes. Uncertainty presents a challenge when trying to optimize and quantify the gains for questions subject to interrelated variables. Fortunately, this challenge is often overcome by a critical assessment of all assumptions that impact the ultimate decisions.

Photo 3Investigation of Damaged Roof Sheathing before Roofing Renewal

For example, moisture damage on the underside of a roof sheathing can be a result of a leak, ventilating with moist outdoor air and/or air leakage. There is often visual evidence to support all these variables as potential culprits. The only solution that is not subject to uncertainly is to turn the roof assembly into a compact roof where all the insulation is outboard the roof structure. This is the most expensive solution and maybe sometimes hard to justify for renewals. Addressing only one potential source, such as air leakage, can be costly and all issues still might not be resolved. Testing and computer modeling can help justify a more targeted approach.

When done right, computer modeling, testing, and visual investigations are only tools to guide decisions and do not provide snapshots of reality. The key to making informed decisions is to embrace uncertainty and know when it's the right time to gain insight by turning to the tools of the trade.

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