Beyond LEED®
ARXX ICF Contributions to Green Building

There is much confusion surrounding what represents green building. This arises out of the use of broad and often ill-defined claims, not to mention overlapping terms such as "energy-efficient building", "eco-building" and "sustainable building".

To help clarify the situation, ARXX commissioned Morrison Hershfield to address the issue in a white paper dealing with ARXX ICFs in relation to Leadership in Energy and Environmental Design (LEED)[1] Green Building rating systems. The conclusion that Morrison Hershfield came to was that many of the green features and benefits inherent in ARXX ICF went beyond the ambit of measurement or performance criteria for LEED. Contained below is an excerpt from their report: Beyond LEED - ARXX ICF Contributions to Green Building.

[1] Visit www.usgbc.org or www.cagbc.org for more information on LEED and LEED Canada.

"All green building assessment tools struggle to obtain a balance between ease of use, accuracy and relevance. The LEED solution leans towards generally well defined prescriptive requirements that ultimately define a LEED building. Due to the wide number of building types, locations and green building attributes, there will inevitably be gaps in the systems, where either benignly green features contribute to a LEED rating or truly green features are not rewarded LEED credits. There are features within LEED (Credit Interpretation Rulings and Innovation in Design Credits) which can be used to resolve some of these gaps".

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The purpose of this document is to point out some of the ARXX ICF green features and benefits that are not directly measured in LEED rating systems, and that might be pursued as either green features irrespective of LEED, or for LEED innovation points or alternative compliance paths for specific LEED credits. Unless otherwise noted, the benefits below have not currently been preapproved for use in LEED (the typical LEED process for approvals must be followed).

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Thermal Mass

- Thermal mass is the ability of a material to retain heat and slowly release it back into the environment. The concrete's thermal mass evens out temperature fluctuations and provides a thermal buffer between indoor and outdoor conditions. This thermal mass effect in an ICF wall tends to reduce heating and cooling loads required in a building, particularly in environments with high temperature swings.

Airtightness

- The concrete within an ICF wall is inherently air tight, and ICF buildings tend to be much more air tight than other building types. Improved air tightness reduces energy use, increases thermal comfort (both through reduction of drafts and better control on air circulation) and can reduce the likelihood of condensation within wall assemblies. Independent studies[2] have found that buildings constructed with ICF are relatively airtight, owing largely to the continuity of the concrete and the ICF assembly. A 60% reduction in air infiltration associated with ICF wall construction can lower a building's peak heat and cooling loads by 57% and 16% respectively.

Acoustic Control

- An ICF based wall assembly provides a very strong acoustic separation. The combination of a lightweight insulation and a heavy mass concrete control a wide range of sound frequencies. ICF wall assemblies can have STC ratings in the mid to upper 40's, far better than a conventional mid 30's to low 40's STC for wood or steel stud wall assemblies.[3] This property can improve the quality of the interior space by either greatly reducing outdoor noise or interior noisy environments.

[2] "Monitored Thermal Performance of ICF Walls in MURBs", Research Highlight, CMHC, Dec. 2007: This study on a seven storey residential apartment building under construction concluded that the average air leakage index was 1.25 L/s/m2 @75 Pa. (28.5 ft3/min/ft2 @1.57 psf).

In comparison, another CMHC study of 11 multi-unit residential buildings found overall indices in the range of 0.9- 10.3 L/s/m2 @ 75 Pa (21 - 235 ft3/min/ft2 @1.57 psf), with an average of 3.19 L/s/m2 @ 75 Pa (73 ft3/min/ft2 @1.57 psf). Other references suggest that typical buildings have a normalized air leakage index in the range of 2- 20 L/s/m2@ 75 Pa (46 - 460 ft3/min/ft2 @1.57 psf).

[3] www.stcratings.com

Security

- The concrete within an ARXX ICF wall can be relied upon to provide superior resistance from projectiles[4] (hurricanes, bombs…) and from break and entry. This is particularly relevant in a changing climate, where increased frequency of extreme climatic events are expected. Materials within wall assemblies can account for significant environmental effects of a building, so extending the life of a building assembly can have positive environmental effects.

[4] *http://www.cement.org/buildings/blast_resistance.asp*

Mold Resistance

- Mold and mildew growth feed on cellulose based material, such as paper in paper faced gypsum board or cellulose in solid or manufactured wood. The major components of ARXX ICF walls are EPS foam, concrete, steel reinforcement and polypropylene connectors. None of these materials are cellulose based, so ARXX ICF tend to be less susceptible to mold or rot, thereby reducing the likelihood of indoor air quality concerns.

Durability

- The inherent properties of ARXX ICF walls (air tightness, security and toughness, mold resistance) enable these wall assemblies to achieve very long lifespans and lower maintenance and repair effects.

Carbon

- In reviewing lifecycle analysis results of ICF wall assemblies[5] over half of the embodied CO_2 is the result of the concrete. The use of supplementary cementicious materials (SCMs) instead of cement can result in lower embodied CO_2, but there are issues with quality of finish and setting and curing times. The nature of ICFs inherently allow longer setting times and the quality of finish is unimportant, so ICFs enable the use of higher SCM content than would be typical. SCM contents of 50% are readily achievable with ARXX ICF, which can lower embodied CO_2 by 20% for the wall assembly.

[5] *Using the Athena Impact Estimator for Buildings, www.athenasmi.org*
Other References: 1. "Factors Affecting the Performance of Ventilation Systems in Large Buildings," Construction Technology Update No. 33, NRC/CNRC 2. "Building Air tightness: Research and Practice", Lawrence Berkeley National Laboratory.