ISSN 1647-0621 (print) ISSN 2182-2743 (on line)
www.ijsc.greenlines-institute.org

International Journal of Sustainable Construction
Vol. 2, No. 1, December 2014, pp. 71-75

The need to link the tangible with the intangible: the challenges of infinite design life and perpetual maintenance

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The challenge of providing a heritage home with perpetual maintenance requires one to think beyond the individual home's boundaries to the collection of other heritage homes in the region surrounding it. The issue with this change in scale from the one to the many is to verify that enough work exists in the region in question for the trades responsible for the individual home's maintenance.

A formula to calculate a wood sash maker's work boundary is proposed. This formula calculates the number of new in-kind replacement windows a given region would generate. This value represents the work needed to support a wood sash maker and apprentice through their professional lives and by extension, guarantee a trans-generational transfer of knowledge. The formula is applied to Nova Scotia.

The larger issue identified in this paper is the symbiotic relationship between a heritage home and the trades who work on the home. Any definition of sustainability needs to recognize and embrace this relationship.

Maintenance in perpetuity

Most buildings are not expected to last forever (Addleson, 1972). The exception is a designated heritage building.

Once heritage status is confirmed, the building's life cycle no longer has an end of life phase (Feilden, 1982). With this change in the building's design life span comes a change in society's relationship with the building. Of particular interest in this paper is how the change to an indefinite design life brings into focus the dependence a heritage building and the trades and crafts responsible for maintaining it in perpetuity have to their local community.

The conversation starts with a review of how a building's relationship to sustainability changes once it becomes a heritage property.

Sustainability

Most interpretations of sustainability (Jorgensen et al., 2013) are based on the Brundtland definition of sustainable development: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (WCED, 1987). Today in Nova Scotia, most non-heritage building are built, retrofitted, and when maintained, to a standard that minimizes the amount of operating energy needed to create a conditioned indoor space[1]. This single-minded approach toward sustainability emphasizes operating energy conservation and, by extension, minimizing the environmental impacts associated with the burning of fossil fuels.

Conserving operating energy can be detrimental to a building's durability whether it be heritage designated or not (Lstiburek, 2008). Yet, this single-issue conservation agenda can be justified because the local culture puts more economic, cultural and ecological value on limiting operational energy consumption than it does on a premature design life and its associated impacts.

With a heritage building, maintaining the building's design life is paramount. Longevity rather than energy efficiency, concerns for trans-generational knowledge and the cultural values associated with the building become the primary concerns for any maintenance program (Jerome, 2010). Building codes are changed (Part 10, Nova Scotia Building Code Regulations, 2011) and reducing operating energy consumption may not be a priority. It is an acceptable, albeit an uncommon practice, to decide to not insulate a heritage building's walls as part of a proposed rehabilitation/maintenance program (Rose, 2005).

Society puts more value on the cultural sustainability of a heritage building. It is no longer considered a machine optimized to meet specific intra-generational objectives but an icon whose trans-generational subjective values outweigh its intra-generational environmental impacts (Jackson, 2005).

Authenticity

A heritage building is made up of a set of materials and systems. The idea of an infinite life span applies to the whole building, not its parts. There is an expectation that over time, the building's parts will wear out and need to be maintained on an as need basis guided by the test of authenticity and practiced according to two principles of heritage conservation, minimal intervention and repair rather than replace in-kind (Alderson, 2006).

These practices' roots go back to Ruskin and have been a consistent theme in all subsequent Western conservation charters and protocols. This approach is intended to keep as much of a building's original fabric in place (Venice Charter, 1964). Along with the values these practices promote comes a bias toward the tangible.

This bias has a detrimental effect on the ability to safeguard the built environment's intangible heritage: the trades and crafts tasked with working on the buildings. As presently practiced, the pursuit of authenticity does not create a sustainable environment with in which a heritage building can be maintained in perpetuity.

For a building maintenance skill to last between generations, the symbiotic relationship between the tangible and intangible has to be nurtured. What is being suggested is that the practice of authenticity be changed or adapted to include the values of the intangible. An exploration of this change is not the direction of the present paper, but it is mentioned as one of the institutional issues that need to be addressed if a heritage building is to be maintained in perpetuity.

The intangible

An example of a traditional building trade that has moved from the mainstream to the periphery is wood sash making. In Nova Scotia, most heritage buildings at one point in their design life had traditional or historic wood windows. These windows are made from solid pine, and can most easily be identified by their single pane, true divided light sashes. The push to energy efficiency has resulted in a number of these wood windows being replaced in both non-heritage and heritage buildings over the past forty years. However, there are still historic windows in the province as well as a demand for replacement in-kind work, the replacement of the old window with a new replica.

Good work, work that is profitable, challenging and not derivative, is sustainable. In the case of wood windows, repair work such as epoxy fill, replacement of sills or re-puttying will meet the demand requirement of "work on the table", but it is not the type of work that will allow the trans-generational transfer of the required skills that need to be learned about how to make a window.

The work must not only challenge the trade, but it has to be of the type they learned. A window maker makes windows. Replacement in-kind of a window is an example of this type of work. It is in making the new that they are doing what they learned.

There must also be enough of this work so that the craftsperson can maintain his or her skill levels. The objective is for the quality of craft to be equal to past generations, and at the same time, allow what the present generation knows be passed onto the next generation.

Too much repair work will not meet these conditions. It is ultimately derivative work. Craftsmen copying and pasting onto existing pieces are not challenged to create new pieces.

For a window maker to be available when needed for a single heritage building, there has to be enough work in the vicinity of this building and the sash maker's shop. As mentioned above, society applies the ideas of sustainability differently to a heritage building. If at some point, the test of authenticity is expanded to include both the tangible and intangible, then the opportunities for work have increased. Even if the above two conditions offer a work opportunity, there is still the question of is there enough replace in-kind work in the vicinity of the window shop.

The wood sash maker's work boundary

Borrowing an idea from life cycle thinking, the question of whether there is enough work comes down to a boundary identification problem. There are two choices: a single building boundary or a wood sash maker's work boundary.

The single building boundary focuses on the single building and its maintenance needs. Immediately one recognizes that replace in-kind work as part of a single building's maintenance plan would occur intermittently through a generation and re-occur on a trans-generational scale. This is not enough work to keep the sash maker trade viable as it relates to the single building.

The wood sash maker's work boundary encompasses the number of heritage and non-heritage houses in a given area that are required to generate enough in-kind window replacement work to keep a craftsperson and apprentice employed through their professional lives. A constant, available material supply is assumed a given for the present exercise. It is assumed that the heritage houses in this area that need window replacement work are a subset of the larger house population.

A distinction has been made between houses and buildings. Buildings include houses, commercial properties and apartments. For the purposes of the present work, given the author's expertise, there is a focus on houses.

The following heritage window in-kind replacement equation (1.0) calculates the number of in-kind replacement windows that would result from a set of heritage houses per year.

$$W \text{ replaced in-kind} = (H \cdot fhh \cdot fw) \cdot (Wwh \cdot fwi\text{-}k). \quad (1.0)$$

W replaced in-kind = number of heritage windows that will be replaced in-kind per year within the boundary;

H = total number of houses within the boundary;

fhh= fraction of heritage houses within the boundary;

fw = fraction of heritage houses that will have window work done within the boundary per year;

Wwh = number of windows per heritage houses that will have window work done within the boundary; and

fwi-k = fraction of windows that need to be replaced in-kind from the total number of windows per heritage houses that will have window work done within the boundary.

As an example, values are used to calculate this boundary for a sash shop based in Halifax, Nova Scotia. These numbers are first order approximations and they should be assessed as such.

W replaced in-kind: 348 (Parsons Lumber Company Ltd. 2013)

It takes 11.5 man-hours to fabricate a 6/6 30" x 30" vertical slider. 348 6/6 30" x 30" vertical sliders or their equivalent need to be made in 50 weeks per year to keep a craftsperson and apprentice occupied.

fhh : 0.01

This value is based on information from the Halifax Regional Municipality website[2].

fw : : 0.01 (Parsons Lumber Company Limited. 2013)

This value is based on author's observations of the heritage window market in Halifax Regional Municipality over the past eight years.

Wwh : 20 (Parsons Lumber Company Ltd. 2013)

This value is based on field observations of heritage buildings in the Halifax Regional Municipality.

fwi-k: 0.5 (Parsons Lumber Company Ltd. 2013)

This value is based on author's observations of the heritage window market in Halifax Regional Municipality over the past eight years.

H = 348,000 houses. In Nova Scotia, 348,000 homes (heritage and non-heritage) would be in an area that includes Halifax Regional Municipality and its surroundings.

To maintain one house, one needs a region

Several iterations of equation (1.1) were executed using different fraction values. The above example is representative of this larger set of work.

The greatest change in values of H occurred as a result of order of magnitude changes in the values of the three fractions. Of the three fractions, the one with the greatest potential for an order of magnitude change is fhh, the fraction of heritage houses within the boundary. In the Halifax Regional Municipality, heritage designation is voluntary.

While the specific values for H varied with each calculation, the set of calculations generated answers for H that were within the same order of magnitude (100,000s). These results suggest that the wood sash maker's work boundary is on the regional scale. The extent of this boundary will vary by region and local conditions but the conclusion is the same. The perpetual maintenance of a single heritage home depends on a pool of heritage and non-heritage homes in the 100,000s contained within a region. Working within this boundary, and taking the sash maker's shop as the boundary area's hub, a sash maker will have enough work for both the present and next generation.

It is not an unexpected conclusion that to keep a building trade economically and culturally viable it needs more work than that which can be generated by a single residential scale heritage house; but there is also another set of conclusions that can be drawn from the work. The sustainability of a perpetual maintenance program depends on recognizing and supporting the relationship between the tangible and the intangible. There is a specific, mutual symbiotic relationship between a set of buildings and the trades responsible for their maintenance. This relationship has to be made explicit in the dialogue about any maintenance program. To date, the recognition of this relationship has come in the form of a unique definition of sustainability as it applies to heritage buildings, the start of a conversation about how the concept of authenticity can include the intangible and what was described in this paper, the work boundary for a given niche building trade.

The boundary idea suggests that there is a critical number of heritage homes required within a specific area for any one of these heritage homes to be maintained in perpetuity. If the number of heritage homes within the region drops below this critical number, the support structure needed to maintain this set in perpetuity will crash. The idea of sustainability as it applies to this problem requires a solution at the community scale, because only at this scale can the relationship between the tangible and intangible be identified and supported.

One has to think beyond the single building when interested in maintaining its infinite design life since there is only so much that can be done at the single building scale. The problem identified in this paper is at the community scale. Ultimately, it will come down to the compromises a community is prepared to make about its heritage buildings that will decide whether these buildings will exist between generations. Any decisions made about a community's heritage buildings must be done knowing the impacts these decisions will have on the trades responsible for maintaining them.

Endnotes

[1] "Energy Solutions" accessed December 16, 2013, www.efficiencyns.ca/energy-solutions/?user-type=4.

[2] http://www.halifax.ca/qol/AffordabilityStats.html#housingtype;

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