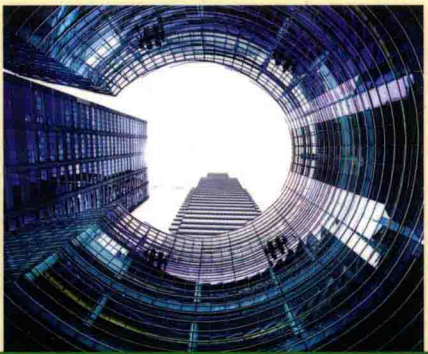

Preparing a Building Service Life Plan for Green Buildings

Dru Meadows

ICC INTERNATIONAL CODE COUNCIL

Mc Graw Hill Education

Preparing a Building Service Life Plan for Green Buildings

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About the Author

Dru Meadows, RA, CCS, FCSI, FASTM, principal with the GreenTeam, Inc., is a specifier, author, teacher, environmentalist, and retired architect with more than 25 years of experience in sustainability consulting and green building. She is a fellow of the Construction Specifications Institute and of ASTM International. Ms. Meadows's work has received recognition from the city of Los Angeles, the state of Oklahoma, the White House, and the United Nations. She is a recognized expert in sustainability standards and has contributed to numerous programs, including the International Organization for Standardization (ISO) standards for service life, for which she chaired the U.S. Technical Advisory Group and served as the American Delegate from 1999 to 2005. Ms. Meadows is the author of the *Federal Green Construction Guide for Specifiers,* with approximately 80 model green specification sections, including a section on facility service life requirements added in December 2010.

Preface

Green building publications generally advance bold, attention-grabbing challenges with sexy solutions. The reader is transported to a deep green utopia in which, with the right effort, everyone will live sustainably ever after.

This is not one of those books.

Service life planning is not sexy. It is not even new. But its use in green building gives it a new twist that is as stunning as it is unexpected.

There is a practical elegance in a green Building Service Life Plan (BSLP). It is applied life-cycle thinking. It doesn't estimate potential environmental consequences. Rather, it outlines a plan of action to help manage impacts. A green BSLP provides guidance on material maintenance (so the service life can be as long as possible) and reuse/recycling options (so the end-of-life impacts can be managed as sustainably as possible).

The concept of a green BSLP is straightforward. Yet, there remains confusion—among service life professionals, environmentalists, and building industry professionals. Some service life professionals resist the new direction, or seek to marginalize it as secondary to economic issues. Economic issues are important, but they are not central to a green BSLP. Environmentalists often fail to distinguish between Life Cycle Assessment (LCA) and applied life-cycle thinking. LCA is a useful evaluation methodology, but doesn't outline a course of action. A green BSLP provides practical information to help you know what to do. And, there lurks a concern in the building industry that a green BSLP might imply some sort of product guarantee or warranty. After all, it talks about product service life. A good, green BSLP does not in any way provide a guarantee or warranty. It is not a promise. It is a plan. It relies upon the user to implement it.

A green BSLP is the new use of an old tool. This book describes that subtle, but powerful, transformation. It identifies the growing adoption of the green BSLP in green building codes and standards.

And, it offers a template that may be used by green building practitioners along with an example of a complete green BSLP. In developing the example, I relied primarily on the related trade organizations for product durability and maintenance information. They are the experts in their fields. Most of them offer a substantial amount of product guidance publicly available online. The text is heavily footnoted accordingly. Hopefully, this will allow the reader to expand his or her research as may be necessary to develop a project-specific green BSLP. And, assist building product manufacturers in their outreach and communication of green service life issues.

—Dru Meadows

Preparing a Building Service Life Plan for Green Buildings

Contents

SECTION 1

Introduction

Will a product work the way it is supposed to? Will it last? These are the basic questions that everyone asks when considering a major purchase. The answers are not entirely dependent on the product manufacture. How we use the product will affect its performance and durability. A well-loved, well-maintained automobile can run smoothly for years. Don't change the oil and you may end up on the side of the road, waiting for assistance. Drive it through a flash flood and you can watch it float away. As any auto mechanic will tell you, if you want your car to provide years of good service, proper maintenance is required.

How are you to know what is "proper maintenance"? Usually, there is an owner's manual. It tells you what performance can be expected, in what conditions, with what type of maintenance. The manual is not a guarantee. It provides information and guidance. It is a kind of service life plan. Most major consumer products today come with an owner's manual describing the service life plan. Buildings do too. Increasingly, a Building Service Life Plan (BSLP) is becoming a core management tool, especially for green buildings.

A BSLP can improve both the economic and the environmental impacts of the building. It improves economic impacts by managing the most costly portion of a building's life-cycle costs, the operation and maintenance stage. Operation and maintenance account for 60 to 85 percent of building life-cycle costs.[1] By guiding appropriate and

[1] *Sustainable Federal Facilities: A Guide to Integrating Value Engineering, Life-Cycle Costing, and Sustainable Development*, Federal Facilities Council Technical Report No. 142; 2001, National Academy Press, Washington, D.C., 2001 http://www.wbdg.org/ccb/SUSFFC/fedsus.pdf (accessed November 14, 2013).

According to the report, the total cost of facility ownership, which includes all costs an owner will make over the course of the building's service life, are dominated by operation and maintenance costs, which account for 60 to 85 percent of building life-cycle costs. Design and construction expenditures will account for 5 to 10 percent of building life-cycle costs. Land acquisition, conceptual planning, renewal or revitalization, and disposal will account for 5 to 35 percent of building life-cycle costs.

necessary investments over the course of the building's life cycle, a BSLP increases the residual value of the building.

A BSLP is useful for both existing buildings and new constructions. It helps facility managers by indicating anticipated future operations and cyclical maintenance. It may also be extended to provide cost plans for maintenance. For existing buildings, many of the choices have been predetermined; and, the building is already some way through its service life. Therefore, a BSLP for existing buildings focuses on assessing the residual service life of building elements and optimizing future operation and maintenance. For new buildings, a preliminary BSLP developed during the design phase can help inform critical decisions that will affect the economic and environmental life-cycle impacts of the building. An updated BSLP, revised at the end of construction to reflect the specific building elements incorporated, can help to achieve the targeted design life and manage the associated costs and environmental impacts.

The common objective of service life planning is to help a product function as it is intended to function for the amount of time it is intended to be used. Service life planning is a management tool. It aims to optimize a product's use by identifying the requisite operations and maintenance for the duration of the product's expected lifespan.

Traditionally, a BSLP was used as a life-cycle costing methodology. It was viewed primarily as a design tool for product selection, with a full suite of standards and protocols developed accordingly. More recently, it has been utilized to manage environmental impacts. Because a BSLP examines use, operation, and maintenance across the targeted service life of a building, it provides an established approach to planning for and management of anticipated life-cycle impacts associated with product durability and end-of-life.

From an environmental perspective, a BSLP is the antithesis of planned obsolescence. Planned obsolescence is a marketing strategy that intentionally shortens a product's lifespan so that the customer must purchase replacements more frequently. Often, the lifespan is dictated by fashion. Changing styles drive consumers to replace otherwise functional products with the new model. Sometimes, unavailability of replacement parts or incompatibility with newer components serves to make the product obsolete. Planned obsolescence and waste go hand in hand. While acknowledging that a product may have a short lifespan, a BSLP anticipates the eventual removal/replacement and helps to delay the necessity of removal as well as guide the economic and environmental impacts associated with the product's end-of-life. By examining the maintenance, repair and replacement

costs for a specified design life, a BSLP tends to encourage interoperability, adaptability, reuse, and recyclability.[2]

A BSLP for green buildings should describe not only repair and maintenance for promoting the durability of major building elements, but also expectations for their removal, reuse, dismantling, and disposal at their end-of-life. This is consistent with BSLP provisions in the model green building codes and standards.

- The International Green Construction Code (IgCC) 2012 includes a BSLP as a project elective. In accordance with the IgCC elective, a BSLP is essentially a "maintenance, repair and replacement schedule... based on the reference service life data" of the major building elements.[3]
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 189.1 delineates requirements for a BSLP. ASHRAE 189.1 Section 10.3.2.3 specifically limits the intent of the BSLP to estimating what components will need to "be repaired or replaced during the service life of the building."
- Green Building Initiative (GBI) Green Globes for New Construction includes a BSLP Credit in the Materials & Resources section of the standard. To achieve the credit, users must identify the reference service life of the building and major building elements. Additionally, they must develop a schedule for maintenance, repair, and replacement for each building element for the duration of the building's design life.[4]

The primary concepts associated with a BSLP are *design life, service life*, and *reference service life*. These have formal, standardized definitions which translate to the vernacular as follows:

- *Design life:* How long you *want* it to last.
- *Service life:* How long it really *does* last.
- *Reference service life:* How long it *should* last (if properly operated and maintained).

Since you can't know the service life until after the fact, a BSLP is written around the design life and the reference service life.

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[2]For additional information on the standardized application of a BSLP, refer to the International Organization for Standardization (ISO) Standard 15686-6:2004, Buildings and constructed assets—Service life planning—Part 6: Procedures for considering environmental impacts.

[3]Refer to IgCC 2012 Appendix A, paragraphs A105.4 and A105.4.1.

[4]Green Globes for New Construction is based upon the content of the ANSI/GBI standards document, *ANSI/GBI 01-2010: Green Building Assessment Protocol for Commercial Buildings.*

A BSLP does not imply or provide a warranty or guarantee of any kind. It does not ensure the performance of the building or any portion, component, and/or system thereof. It does not guarantee the life-cycle impacts. It is a plan. Like the owner's manual for your car, it provides information and guidance to help you keep your building running smoothly throughout its anticipated life. Additionally, the information in a BSLP can address the end-of-life issues. This is the reason green building practitioners have embraced the BSLP.

BSLPs are attractive for green buildings because they offer a method to extend resource management, especially waste management, across the entire life of a building. The BSLP doesn't require that each product incorporated into a building have an expected lifespan equal to the building's lifespan. It does mean that there should be a plan to recycle or reuse a product when it is removed and/or replaced. A product might be removed in 5 years, 10 years, or 50 years. It might be removed for a variety of reasons. Perhaps it is no longer useful. Perhaps a newer model offers better service. The BSLP can provide guidance on eco-efficient options in removing and reclaiming the product. In this respect, BSLPs address a significant and otherwise unmanaged facet of green building. The BSLP helps to implement life-cycle thinking. It helps close-the-loop through planned management of the end-of-life impacts associated with different materials and components.

The purpose of a BSLP for a green building is to provide a plan for managing the performance requirements and life-cycle impacts (including end-of-life) of the major building elements for the duration of the design life (the intended lifespan) of the building.

A BSLP for a green building should:

- Identify the design life of the building. *Design life* is the intended service life—the period of time targeted for a building or its component parts to meet or exceed the performance requirements.
- Identify the major building elements. Major building elements include items that represent a significant percentage of initial construction cost and/or facility operation cost. Major building elements typically do not include accessory items or equipment and systems related to occupant operations such as furniture, artwork, computers, and manufacturing equipment. Major building elements should include
  - Structural elements
  - Concealed or inaccessible elements
  - Elements for which replacement is cost prohibitive or impractical

  - Major replaceable elements
  - Mechanical, electrical, plumbing, and systems
  - Roofing
  - Site hardscape
- State the reference service life and basis of determination for each major building element. The *reference service life* is the service life that a building or its elements is expected to have under normal in-use conditions. It is important to recognize that a building element need not last as long as the design life of the building. However, the life-cycle impacts, such as anticipated future repairs, removal, reuse, dismantling, and recycling/disposal, should be identified so that they can be managed in accordance with the design intent.
- Describe in-use conditions for each major building element. Products are designed to function in specific applications. These applications are the "in-use conditions" and can dramatically affect the performance and durability of the product. Imagine trying to use bicycle tires on an automobile. Or, snow tires in the tropics. While both types of tires serve the general purpose of a wheel, in order to function optimally, each must be used in the manner intended.
- Describe normal maintenance, repair, and replacement for each major building element for the duration of the building design life. It is never possible to envision every potential problem that might be faced. It is possible to anticipate the maintenance that will be needed due to normal wear and tear.
- Describe the adaptability of each major building element, including the potential for repurposing, reuse, and recycling. What happens at the product's end-of-life? How do we create the infrastructure to cycle our material resources continuously? How do we move from waste minimization to waste elimination? The goal of zero waste is one of the biggest challenges that green building faces.

  "The building industry commandeers 3 billion tons of raw materials annually—40 percent of total global use. It uses almost half of all the mined, harvested, and dredged raw materials each year! Approximately 20 percent of those materials end up as construction waste. That is an estimated 600 million tons of material annually. About a third of that is in the United States alone. The majority of building industry waste is 'clean' waste, scrap materials that have not been used

but have merely paused momentarily on their brief and fairly direct path from manufacturer to landfill. Think about it. Six hundred million tons of material. That's roughly 400 million cars. Parked end-to-end, that's enough cars to circle the Equator over 60 times. Per year."[5]

A BSLP provides a critical first step in managing the building industry's wastestream long term.

Section Two provides an example of a BSLP for a green building project. The example includes general project information and guidance. Additionally, it includes common major building elements with information organized according to a fill-in-the-blank template as shown below.

BSLP—Major Building Elements Template

Name/Description: _____

Classification

UNIFORMAT II[6] (*list applicable alpha-numeric designations*) _____

MasterFormat[7] (*list applicable specification sections*) _____

Reference Service Life

Years: _____

Reference Service Life is equal to or greater than Building Design Life

Yes _____ No _____

[5]Meadows, Bell and Whitaker Jr.; RETHINKING RECYCLING: An Economic Perspective of Our Next 109 Years for the Building Industry & Others; 2012, theGreenTeam, Inc.; p. 13.

[6]ASTM E1557–09 Standard Classification for Building Elements and Related Sitework-UNIFORMAT II. ASTM E1557 delineates an organizational framework, called UNIFORMAT II, which is commonly used to organize project information for estimating, planning, and construction management. The classification incorporates hierarchical levels with increasing detail; level 1 is the most general and level 4 the most specific.

[7]MasterFormat-2004 is a standard for organizing construction specifications and other written information for building projects in North America. It is a publication of the Construction Specifications Institute (CSI) and Construction Specifications Canada (CSC). Information is organized by Divisions, with each Division containing more detailed Sections. MasterFormat numbers are 6 digits; the first two represent the division number, the second two represent the general section number, and the last two may be used to further distinguish grouping of information within a general section.