International Rating Systems And Their Applicability On Historic Buildings

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Abstract: - This paper presents a review of the guidelines set by different rating systems around the world, to deal with historic buildings. it addresses the many aspects of rating tools and weighing of credits criteria in order to better understand the mutual relationship between the existing situation and the goal to reach. first, the particular cosiderations of rating systems are reviewed. Finally, all aspects are combined into a table that contains a full list of rating tools categories that could be implemented on historic buildings, with high performance.

Key-Words: - Rating credit, green building, renewable energy, historic building, energy efficient.

1 Introduction

Green rating systems enhances the design process by offering guidelines and metrics that improve collaboration and provide a framework that defines sustainability and links project issues and solutions within the context of sustainability. Also it provides economic benefits by reducing waste and energy costs and provides opportunities for tax incentives and long-term operating cost savings. Using a green rating system often results in a more efficient, durable and resilient project. Projects rated green are better designed to prevent losses from fire and plumbing damage and withstand unpredictable energy prices. Green rating systems challenge teams to look at the project from new angles that present possibilities for reducing costs, extending project life, attracting investors, appealing to stakeholders and the public, improving community well-being and many other benefits that increase the owner's competitive edge. These rating systems also promote stakeholder participation and provide milestones, which help to monitor progress and keep the project team on track. Projects designed with the sustainable framework of a green rating system create more livable and resilient communities with reduced waste, opportunities to conserve and protect natural ecosystems, and residents who enjoy improved air and water quality.

2 Research objectives

The objective of this study is to identify the ratings barriers needed for applying green historical restoration projects. When working with a suite of standards that is in conflict with the designer's goal of maintaining authenticity, obstacles tend to arise. The intent of this study to compare obstacles that arose during restoration projects, which lead the architect to choose between scoring the building versus making restoration more authentic.

With so many systems, still there is no rating system that can be applied to historical preservation, except for LEED-V4 wich started to add 10 points directly support preservation activities. This is where the problem arises for preservationist professionals, because they are having to force fit their project into one of the existing systems while still attempting to maintain the authenticity of the structure. If the designer wishes to create a recognized green building, they must work with a suite of standards that at times is in conflict with their goal of maintaining authenticity.

This research will benefit the construction industry by demonstrating the need for a green rating system that allows historical buildings to integrate the restoration process with the sustainability and energy efficiency rating system.

3 International rating models

RATING SYSTEM	ORIGIN COUNTRY
LEED	American
GREEN PYRAMID	Egyptian
BREEAM	United Kingdom
CASBEE	Japanese
Green Star	Australian
Estedama Pearl	Abu Dhabi
Green mark	Singapore
Gbtool	South Africa
Green Glob	American
BEAM	Hong Kong
GBAS	China
NABERS	Australia
Green Key	United Arab emirates
DGNB	German
HQE	French
GKHA	India

Table 1: rating systems origin, by the researcher. [1]

In the folowing papers some of the previous rating systems will be analytically presented.

2.1 LEED (Leadership in Energy and Evironmental Design)

LEED is Developed by the U.S. Green Building Council USGBC in 2000 through a consensus based process, LEED serves as a tool for buildings of all types and sizes.

It was designed to provide the industry with a suite of standards for the environmentally sustainable design, construction, neighborhoods, and building operations. The building's design committee uses a checklist to measure ensure that the new building maximizes energy use [2]. In the beginning, USGBC started with just LEED for New Construction;
after that new rating systems were added:

1. LEED for Building Design + Construction BD+C
2. LEED for Interior Design + Construction ID+C
3. LEED for Building Operations + Maintenance O+M
4. LEED for Neighborhood Development ND

In LEED-ND (2009 v3) neighborhood development and new construction, this system is the most used one for historic buildings; as Historic preservation values are particularly addressed in NPD Credit 1: Walkable Streets and GIB, Credits 4: Existing Building Reuse and credit 5: Historic Building Preservation & Reuse. These credits represent a much stronger recognition of historic preservation laws and concepts than has heretofore existed. To achieve this credit, no historic building or portion of a historic building may be demolished as part of the project. An exception is granted only in instances where approval for such action is provided by the appropriate review body, For buildings listed locally, the local historic preservation review board, or equivalent body must grant approval, For buildings listed in a State Register or in the National Register of Historic Places, approval must appear in a programmatic agreement with the State Historic Preservation. It is worth noting that it would still be possible, with this current construction, to demolish a historic building and simply not opt for either of these two credits, as it is only a prerequisite for these two credits, and not for LEED ND on the whole.

A new rating system has been developed to meet the need of the historic buidings called LEED for Neighborhood Development and historic presevation LEED-ND V4 (march 2013)
This new system has to Consider preservation and adaptive reuse value-added in green building projects. LEED-ND projects and historic resources attempt to either create or preserve distinct places, where visitors feel connected to their communities and to the built environment through appreciation of the past or a plan for the future. this program is not designed to rate individual buildings. Rather, it takes into account the connections between buildings and their context as well as the natural environment.

The new certification Greenbuild 2013: LEED v4 adds specific points for historic preservation and adaptive use in the newly introduced Building Life-Cycle Reduction Impact credit. [3]

"Now any building listed in the National or State Registers and/or locally designated automatically gets 5 points, a victory for old buildings that are inherently sustainable." [4]

Four levels for green building certification LEED-ND v4:

1. Certified: 40 to 49 points.
2. Silver: 50 to 59 points.
3. Gold: 60 to 79 points.
4. Platinum: 80 to 110 points.

Projects are rated based on credit points accumulated according to their performance in the next eight rating category elements.

1. Location and Transportation: to encourage communities to consider location, transportation alternatives, and preservation of sensitive lands while also discouraging sprawl.
2. Sustainable Sites: to reduce pollution from construction activities controlling soil erosion, waterway sedimentation, and air dust. And to ensure that the site is assessed to environmental contamination.
3. Water Efficiency: to reduce water consumption and to support water management and identify opportunities for additional water saving.
4. Energy & Atmosphere: to support the design, construction, and eventual operation of a project that meets the owner's project requirements for energy, water, indoor environmental quality, and durability.
5. Materials & Resources: to reduce construction and demolition waste disposed of in landfills and incineration facilities by recovering, reusing, and recycling materials.
6. Indoor Environmental Quality: to contribute to the comfort and well-being of building occupants by establishing minimum standards for indoor air quality.
7. Innovation & Design Process: recognizes exemplary and innovative performance reaching beyond the existing credits in the rating system, as well as the value of including an accredited professional on the design team.
8. Regional Priority: encourages projects to focus on earning credits of particular significance to the project's local environment.

2.2 GPRS (Green pyramid rating system)

Egyptian stakeholders and government officials have looked for methods to reduce power consumption and Green House Gases emissions (GHG).

Egypt green building council has commissioned to define the framework of a rating system and a national committee has been formed to review and ultimately approve the Green Pyramid Rating System completed and took place 2010. Recognizing the unique ecological, industrial and social challenges of the region, the rating system will help to define what constitutes an "Egyptian Green Building". [5]

Four levels for green pyramid certification:

1. Certified: 40 to 49 credits.
2. Silver Pyramid: 50 to 49 credits.
3. Golden Pyramid: 60 to 79 credits.
4. Green Pyramid: 80 credits and above.

Projects are rated based on credit points accumulated according to their performance in the next seven rating category elements.

1. Sustainable Sites Development: to avoid projects which have negative impact on historical and protected areas and the redevelopment in informal areas, also to minimize the negative environmental impact of the project on its surrounding.
2. Water Saving: to develop and implement a comprehensive water strategy.
3. Energy Efficiency and Environment: to reduce energy consumption and carbon emission by incorporating passive design strategy.
4. Materials Selection and Construction System: to enable the use of renewable, recycled, highly efficient, and local materials and avoid wastage.
5. Indoor Environmental Quality: to promote thermal, visual and acoustic comfort for occupants.
6. Innovation and Design Process: mix design reflecting national and regional cultural heritage value wile contributing to environmental performance of the building.
7. Recycling of Solid Waste: design initiatives and construction practice, which have significant measurable environmental benefit. [6]

2.3 BREEAM (Building Research Establishment's Environmental Assessment Method).

Launched in 1990 by the Building Research Establishm (BRE) and used across Europe. it is an environmental assessment method and rating system for buildings. It encourages designers, clients and others to think about low carbon and low impact design, minimizing the energy demands created by a building before considering energy efficiency and low carbon technologies[7].

A BREEAM assessment uses recognised measures of performance, which are set against established benchmarks, to evaluate a building's specification, design, construction and use. The measures used represent a broad range of categories and criteria from energy to ecology. They include aspects related to energy and water use, the internal environment (health and well-being), pollution, transport, materials, waste, ecology and management processes.

A certificated BREEAM assessment is delivered by a licensed organisation, using assessors trained under a UKAS accredited competent person scheme, at various stages in a buildings life cycle. This provides clients, developers, designers and others with:

- market recognition for low environmental impact buildings,
- confidence that tried and tested environmental practice is incorporated in the building,
- inspiration to find innovative solutions that minimise the environmental impact,
- a benchmark that is higher than regulation,
- a system to help reduce running costs, improve working and living environments,
- a standard that demonstrates progress towards corporate and organisational environmental objectives.

Five levels for BREEAM certification:

1. Pass: 25 to 40%
2. Good: 40 to 55 %
3. Very good: 55 to 70 %.
4. Excelent: 70 to 85 %.
5. Outsanding: 85% and above.

The following types of building can be assessed:

Under BREEAM 2011 New Construction

- Whole new buildings
- Major refurbishment of existing buildings
- New build extensions to existing buildings
- A combination of new build and existing building refurbishment

Under BREEAM 2008

- Existing building fit outs – all building services, finishes and fittings are assessed

Projects are rated based on credit points accumulated according to their performance in the next rating category elements: [8]

- Management: 12 %
- Health and wellbeing: 15 %
- Energy: 19 %
- Transport: 8 %
- Water: 6 %
- Materials: 12.5 %
- Waste: 7.5 %
- Land use and ecology: 10 %
- Pollution: 10 %

1. Management: deals with sustainable procurement, responsible construction practices, construction site impacts, stakeholder participation (including consultation with relevant parties, accessible design, building user information and post-occupancy evaluation), life-cycle costing and service-life planning
2. Health and Wellbeing: deals with aspects design that impact on the health or wellbeing of building occupants, including visual and thermal comfort, indoor air and water quality, acoustic performance, and providing low-risk, safe and secure access to and use of buildings.
3. Energy: deals with the reduction of carbon emissions, including the use of energyefficient building services, plant and equipment, low- or zero-carbon energy-generating technologies, and the ability to monitor energy use by sub-metering.
4. Transport: deals with access to adjacent public transport networks and local amenities, along with the provision of information on travel options to building occupants, the provision of cyclist facilities and the limitation of car parking.
5. Water: deals with opportunities for reducing water consumption through the use of efficient sanitary ware, the reuse and recycling of water, the provision of leak detection and prevention of leaks, monitoring controls and the provision of water-efficient equipment.
6. Materials: considers the embodied life-cycle environmental impacts of materials, the use

of responsibly sourced materials and the robustness of the building fabric.

7. Waste: deals with reducing construction waste, the possible use of recycled aggregates, the provision of space to encourage operational recycling and encouraging the specification of finishes by the building's occupants.
8. Land Use and Ecology: considers the environmental impact of site selection including its ecological value and the protection of existing ecological features, mitigating the impact on and enhancing the ecological value of a site and limiting any long-term impacts on a site's biodiversity.
9. Pollution: deals with the impacts of refrigerants and nitrous oxide emissions, the impacts of surface water run-off from a site and the impact of light and noise pollution on neighbours.
10. Innovation: introduced additional credits that could be awarded in recognition of achieving either exemplary levels of performance in certain Issues or for incorporating innovative sustainability solutions within a building's design.

2.4 CASBEE (Comprehensive Assessment System for building Environmental efficiency). [9]

CASBEE system was developed in japan, beginning in 2001. The family assessment tools is based on the building's life cycle: pre-design, new construction, existing building and renovation. It presents a new concept of assessment that distinguishes environmental load from quality of building performance. By relating these two factors CASBEE results are presente as a measure of eco-efficiency or BEE (building environmental efficiency). Results are plotted on a graph, with environmental load on one axis and quality on the other, the best buildings will fall in the section representing lowest environmental load and highest quality. Scores are given based on the scoring criteria for each assessment item.

A five-level scoring system is used:

- C: BEE of 0 to 0.49
- B-: BEE of 0.5 to 0.99
- B+: BEE of 1 to 1.49
- A: BEE of 1.5 to 2.99
- S: BEE of more then 3.0

Different types of assessments:

- CASBEE for New Construction
- CASBEE for Existing Building
- CASBEE for Renovation
- CASBEE for Heat Island
- CASBEE for Urban Development
- CASBEE for an Urban Area + Buildings
- CASBEE for Cities
- CASBEE for Home (Detached House)
- CASBEE for Market Promotion
- CASBEE Property Appraisal

Four basic assessment tools:

- CASBEE for Pre-design - CASBEE-PD: aims to assist the owner, planner and others involved in the planning (pre-design) stage of the project. It can be used to assist in grasping issues such as the basic environmental impact of the project, in selecting a suitable site, and to evaluate the environmental performance of the project in the pre-design stage.
- CASBEE for New Construction - CASBEE-NC: is used by architects and engineers to increase the BEE value of a building during the design process. This can be used as a design support tool as well as a self check list. This tool, formerly named DfE (Design for Environment) tool, makes assessments based on the design specifications and the anticipated performance.
- CASBEE for Existing Buildings - CASBEE-EB: targets existing building stock, based on operation records for at least one year after completion. The tool was also developed to be applicable to asset assessment. It can be used as a labelling tool to declare the environmental performance of buildings. CASBEE-EB is also utilized to support building maintenance. Building owners, such as the real estate sector and large enterprises, may use it as a self-evaluation tool for midterm and long-term management plans.
- CASBEE for Renovation - CASBEE-RN: is designed to evaluate the performances of existing buildings based on predicted performance and specifications with renovation. CASBEE-RN may also assess improvement of specific performance in relation to the purpose of the renovation. [10]

Two Categories of Assessment: Q and L

1. Q (Quality): Built Environment Quality: Evaluates improvement in living amenity for the building users, within the hypothetical enclosed space (the private property).
- Q1 - indoor environment
- Q2 - quality of service
- Q3 - outdoor environment on site

2. L (Load): Built Environment Load: Evaluates negative aspects of environmental impact which go beyond the hypothetical enclosed space to the outside (the public property).
- L1 - Energy
- L2 - resources and materials
- L3 - off-site environment

4 Conclusion

This research indicates that these tools can each play a valuable role in encouraging higher-performing buildings, but there is no presence of a special tools concerning historic or heritage building which can cause confusion in the market.

The global principles of green architecture such as energy conservation and climate adaptation, planning a sustainable building site, economizing water consumption, efficient use of construction materials, indoor environment quality, recycling solid waste, design and innovation and respect of users. [11]

Building activities are one of human's most influential activities on natural resources and the environment. Scientific development philosophy must be steadily created and seriously implemented, and the concept of sustainable development must be adhered to, to strongly develop green buildings. When developing green buildings, state technologic and economic policies that save resources and protect environment shall be implemented and performed. The purpose of formulating this standard is to regulate evaluation on green buildings and promote the development of green buildings.

Due to different functions, different types of buildings have big discrepancy in terms of resource consumption and effect on environment. Considering current construction market, this standard will mainly evaluate residential buildings that are huge in quantities and public buildings that consume much energy and resources, like office buildings, mall buildings and hotel buildings. But for evaluation on historic buildings, this standard can serve as reference. So there is a need of a balanced system concerning just the historic building with their value and its major impact on the social and economic aspect of the country.

There is huge difference in climate, geographic environment, natural resources, economic development and social customs in different regions, so in evaluation of green buildings, differently regions shall be viewed respectively, taking regional specialties into consideration based on fact, and the climate, resources, natural environment, economy and culture of the region where the building locates shall be fully considered. Laws, regulations, and related standards in accordance with state requirement are prerequisite for historic green building evaluation. [12]

		GREEN BUILDING FACTORS									
		Location and Transportation	Sustainable Site	Water Efficiency	Energy and Atmosphere	Materials and Resource	Indoor Environmental Quality	Innovation in design	Regional Priority	Recycling of solid waste	Green infrastructure
Historic preservation factors	Political								x		
	Legal	x				x		x		x	x
	Socio-cultural	x	x	x						x	
	Economic			x	x	x				x	x
	Environmental	x	x	x	x	x	x			x	x
	Organizational capacity	x			x			x			
	Educational		x	x						x	
	Neighborhood revitalization	x	x		x			x			x
	Construction documents		x								x

Table 2: relation between historic building factors and green building factors, by the researcher. [13]

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