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LEED AND BREEAM SUSTAINABLE SITES RATING FOR FAMILY HOUSE IN SLOVAKIA

Annotation: This paper presents a comparison between two different rating systems to evaluate buildings sustainability: LEED (USA) and BREEAM (Great Britain). By comparing results of family house assessment for selected fields of assessment by LEED and BREEAM it can be state that the family house obtained 38.5% in category Sustainable sites in LEED and 41 % in categories of Transport and Land use in BREEAM.

Keywords: Sustainability assessment, LEED, BREEAM, family house

Introduction. LEED rating system encourages an integrated design approach, with a point's scheme that allots credits for building design features deemed to improve sustainability, which includes reductions in energy use, improvements in indoor environment quality, protection of the construction site, reduction in water consumption and use of sustainable materials [1]. BREEAM measures sustainable value in a series of categories, ranging from energy to ecology. Each of these categories addresses the most influential factors, including low impact design and carbon emissions reduction; design durability and resilience; adaption to climate change; as well as ecological value and biodiversity protection [2].

This paper deals with assessment of family house by LEED rating system from year 2009 and BREEAM rating system from year 2016 in Sustainable sites categories. Evaluated family house is located in Košice, Slovakia. Obtained credits can be divided into two categories – (1) binary credits, which use 0 or 1 to represent whether the credits are achieved, and (2) multi-point credits, which mean better building performance if higher points are achieved.

Family house characteristics - Family house is located in Košice, Slovakia at Breznianska Street as part of project of intended construction of houses. House is semi-detached dwelling facility and has 2 floors, basement, own parking spot for one car and own garden. On the first floor are two bedrooms, living room, kitchen, and toilet. On the second floor is one bedroom with wardrobe and a bathroom. House is new with own central heating. Constructions of outer walls are from Porotherm bricks with thickness of 250 mm and 150 mm of thermal insulation. Internal partitions are also from Porotherm bricks with thickness of 115 mm. Concrete belt

foundations have thickness of 350 mm. Saddle roof has 45 % inclination with area of 132 m².



Figure 1: Situation of family house

Assessment of family house by LEED. As we can see on the figure 2, the family house in the sustainable sites rating reached 10 from possible 26 points.

 **LEED 2009 for New Construction and Major Renovations**
Project Checklist

10		Sustainable Sites	Possible Points: 26
Y	?	N	
Y			Prereq 1 Construction Activity Pollution Prevention
1			Credit 1 Site Selection 1
			Credit 2 Development Density and Community Connectivity 5
			Credit 3 Brownfield Redevelopment 1
6			Credit 4.1 Alternative Transportation—Public Transportation Access 6
1			Credit 4.2 Alternative Transportation—Bicycle Storage and Changing Rooms 1
			Credit 4.3 Alternative Transportation—Low-Emitting and Fuel-Efficient Vehi 3
			Credit 4.4 Alternative Transportation—Parking Capacity 2
1			Credit 5.1 Site Development—Protect or Restore Habitat 1
1			Credit 5.2 Site Development—Maximize Open Space 1
			Credit 6.1 Stormwater Design—Quantity Control 1
			Credit 6.2 Stormwater Design—Quality Control 1
			Credit 7.1 Heat Island Effect—Non-roof 1
			Credit 7.2 Heat Island Effect—Roof 1
			Credit 8 Light Pollution Reduction 1

Figure 2: LEED rating for family house sustainable sites [3]

Site selection – Mentioned family house successfully meets this criteria for credit in this category because the land of house is not within 15 meters of any wetland like

lake, river etc. Land also was not previously considered as project for public parkland or any other similar content.

Development density and community connectivity - Building does not meet any of criteria for credit in this category because is far away (more than 800 meters) from any of following basic services - bank, library, grocery, restaurant, place of worship, school, pharmacy, medical or dental office, supermarket etc.

Brownfield redevelopment - This category is focused on land which is defined as a brownfield, and intent to rehabilitate damaged sites where development is complicated by environmental contamination and to reduce pressure on undeveloped land. House fails in this category.

Alternative transportation - Public transport access- Intent of the category is to reduce pollution and land development impacts from automobile use. Mentioned family house has public access like bus stop which is closer than 800 meters walking distance and also has within 400 m walking distance of 1 or more stops to another bus stop.

Alternative transportation - Bicycle storage and changing room - This category has similar intent than previous and family house fulfil all requirements which are needed - provide bicycle racks in 200 m distance of a building entrance for 5% or more of all building users. Provide covered storage facilities for securing bicycles for 15% or more of building occupants.

Alternative transportation - Low emitting and fuel-efficient vehicles - House in this category does not have a parking spots for low emitting vehicles. There are not alternative-fuel fuelling stations and also there are not any low-emitting vehicles for occupants.

Alternative transportation - Parking capacity - Preferred parking for this case is not for carpools or vanpools and also not for 5% of total parking spaces.

Site development - Protect or restore habitat - Family house meets requirements such as 12 m beyond the building perimeter and parking garages; 3 m beyond surface walkways, patios, surface parking and utilities less than 30 cm in diameter; 4.5 m beyond primary roadway curbs and main utility branch trenches; 8 m beyond constructed areas with permeable surfaces.

Site development - Maximize open space - This family house needs to have at least 20% of vegetated open space of full area of land. Garden which is open space equal to 20% of the project site area it successful accomplished requirements for this category.

Storm water design - Quantity control - Requirements are not accomplished in any possible options. House does not have any storm water management plan that prevents the post development peak discharge rate and quantity from exceeding the

predevelopment peak discharge rate and quantity for the 1- and 2-year 24-hour design storms.

Heat island effect - Non-roof - In this case there are not usage of any combination strategies for 50% of the site hardscape. On the land there are not any shades from the existing trees, covered by solar panels, architectural devices for SRI or any hardscape material. Non-roof points can be also if house would have under cover place for at least 50% of parking spots.

Heat island effect - Roof - Requirements for this category are that roof needs to have minimum SRI- (Solar reflectance index) at least 75%. According to calculations it doesn't have that value. Second option how to get credit is if roof was vegetated but the designed roof isn't vegetated.

$$\frac{\text{Area Roof Meeting Minimum SRI}}{\text{Total Roof Area}} \times \frac{\text{SRI of Installed Roof}}{\text{Required SRI}} \geq 75\%$$

Figure 3: Calculation formula for SRI [3]

Light pollution reduction - Building doesn't have any kind of automatically closing window/door system or system for reduction the input power. Doors and windows can be open only manually and house doesn't have nonemergency interior luminaries with a direct line of sight.

Assessment of family house by BREEAM. As we can see on the figure 3, the family house in the field of transport and land use and ecology reached 9 from possible 22 points.

Transport		Points	Possible points
Tra 01	Public transport accessibility (Dostupnosť hromadnej dopravy)	5	5
Tra 02	Proximity to amenities (Blízkosť občianskej vybavenosti)	2	2
Tra 03	Alternative modes of transport (Alternatívne spôsoby dopravy)	2	2
Tra 04	Maximum car parking capacity (Max. kapacita parkoviska)	0	2
Tra 05	Travel plan (Dopravný plán)	0	1
Land Use and Ecology (Využitie zeme a ekológia)			
LE 01	Site selection (Výber pozemku)	0	3
LE 02	Ecological value of site and protection of ecological features (Ekologická hodnota miesta výstavby)	0	2
LE 04	Enhancing Site Ecology (Zveľadenie ekológie miesta výstavby)	0	3
LE 05	Long term impact on biodiversity (Dlhodobý dopad na biodiverzitu)	0	2

Figure 4: BREEAM rating for family house sustainable sites [2]

Public transport accessibility- Near to the family house (category Long term residential institutions) is bus stop and it services stopping every 15 minutes. Approximately 300 m from main entrance which "AI" index 3.

Accessibility Index	≥0.5	≥1	≥2	≥4	≥8	≥10	≥12	≥18
Building type			BREEAM credits available					
Offices, Industrial, Long term residential institutions, Other building - Staffed	-	-	1	2	3	-	-	-
Preschool, School	-	-	1	2	3	-	-	-
Retail, Higher education - Off campus, Hotels and short term residential institutions, Other building - Visitors	-	-	1	2	3	3	4	5
Higher education - On campus	-	-	1	2	3	4	5	-
Rural location sensitive buildings, Other buildings - Rural,	-	-	1	2	-	-	-	-
Residential dwellings	1	2	3	4	-	-	-	-

Figure 5: BREEAM credits available for each building type relating to the public transport Accessibility index (AI) score [2]

Proximity to amenities - According to local plan there are not any type of amenities closer than 500 m from building. Postal facility, access to cash, access to recreation are around 900-1000 m from building.

Alternative modes of transport - Aim is to provide facilities which encourage building users to travel using low carbon modes of transport and to minimise individual journeys. For building with 1-200 users building needs to have 1 space for 10 users. There is place for parking bicycles and also storage under cover and also improvement of traffic infrastructure.

Maximum car parking capacity – This issue is not applicable for this type of building.

Travel plan - As was mentioned, there is recent improving of traffic infrastructure but there is not access for handicapped people, any improvement of traffic lights near sidewalks.

Site selection - Land in this case did not suffered by contamination and also any brownfield, land was not occupied by industrial, commercial or domestic building.

Percentage of the proposed development's footprint on previously developed land	Credits
75%	1
95%	2

Figure 6: BREEAM credits Percentage of proposed development's footprint on previously developed land [3]

Ecological value of site and protection of ecological features - Any kind of protection of ecological features and also no ecological value of site. Construction site doesn't have any protection from damage and is no defined as "land of low ecological value".

Enhancing site ecology - Building didn't pass any kind of ecology reports and recommendations. The planting of locally appropriate native species is not benefit to local wildlife. Any installation of bird, bat or insect boxes at appropriate locations on the site.

Long term impact on biodiversity - Management of construction activities do not confirm that all relevant, national regulations or legislation requirements relating to the protection and enhancement of ecology have been complied with during the design and construction process.

Conclusion

In this study, a methodology based on data according to LEED and BREEAM environmental techniques which were developed, we explored possibility of using these data. This reflects the potential of implementing data in solving sustainable sites, location problems, and possibilities of location transports and also ecology value of site. Developed LEED environmental system can consider owner type of family house, project size, and target of certification level of project, but also included the local public problems like for example travel plan, alternative transport possibilities. BREEAM can also solve these problems but they are reduced and divided to different categories. Obtained credits can be divided into two categories – (1) binary credits, which use 0 or 1 to represent whether the credits are achieved, and (2) multi-point credits, which mean better building performance if higher points are achieved.

By comparing results of family house assessment for selected fields of assessment by LEED and BREEAM it can be state that the family house obtained 38.5% in category Sustainable sites in LEED and 41 % in categories of Transport and Land use in BREEAM.

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Анотація:

У даній статті наводиться порівняння між двома різними рейтинговими системами для оцінки стійкості будівель: LEED (США) і BREEAM (Великобританія). Порівнюючи результати оцінки котеджного будинку для обраних систем оцінки по LEED і BREEAM можна стверджувати, що будинки отримують 38,5% в категорії стійких енергозберігаючих позицій в LEED і 41% в категорії транспорту і землекористування в BREEAM.

Ключові слова: оцінка стійкості, LEED, BREEAM, котеджний будинок

Аннотация:

В данной статье приводится сравнение между двумя различными рейтинговыми системами для оценки устойчивости зданий: LEED (США) и BREEAM (Великобритания). Сравнивая результаты оценки коттеджного дома для избранных систем оценки по LEED и BREEAM можно утверждать, что дома получают 38,5% в категории устойчивых энергоэффективных позиций в LEED и 41% в категории транспорта и землепользования в BREEAM.

Ключевые слова: оценка устойчивости, LEED, BREEAM, котеджный дом