

# Comparison Of Design Criterias About Location and Transportation In Healthcare Building According To BREEAM And LEED Certification Systems

*C.Kurtay<sup>1\*</sup>, S. Jahed<sup>2</sup>*

*<sup>1</sup>Department of Architecture, Gazi University, Ankara, Turkey*

*<sup>2</sup>Department of Architecture, Gazi University, Ankara, Turkey*

## Abstract

Nowadays, certification systems have evolved due to increased energy consumption and limited resources. Certification systems have evolved to make buildings in the world more liveable, green and sustainable, and there is also lots number of certification systems. In this Study, the most applied and preferred BREEAM [1] and LEED [2] certification systems from certification systems will be examined and compared to the criteria and control systems they have established for the location and transportation in health-based hospital buildings. Especially in Turkey, there is a new breakthrough in health issues and major hospitals are being built. However, there are no clear standards to qualitatively refer to these in the context of sustainable construction. Therefore, in this study, it is aimed to make a contribution on the transportation which is one of the conditions of being green and sustainable in health facilities.

**Key words:** Healthcare buildings, BREEAM, LEED, Transportation, certification systems

## Abbreviations:

BREEAM : Building Research Establishment Environmental Assessment Methodology,

LEED : Leadership in Energy and Environmental Design

## 1. Introduction

The aim of the study is to reveal common points and different points of view, viewpoints and control systems under the headings of BREEAM and LEED on location and transportation in health-based hospital structures. We talk about LEED v4 for building design and construction and BREEAM international new construction 2016 systems in healthcare building. There are eight groups for the LEED certification system: Sustainable sites water efficiency energy and atmosphere, materials and resources, indoor environmental quality, innovation, location and transportation and regional priority. BREEAM certification system collected under ten groups. These are grouped under ten headings as Health and wellbeing, Management, energy, water, land use and ecology, transport, materials, waste, pollution and innovation.

## 2. Method

With BREEAM 2016, the LEED v4 2017 certification system was examined and the criterias under each heading were examined and the similarities and differences were revealed by comparing the conditions of each item with each other. Therefore, the titles, criteria, requirements and scores that are important for two different certification systems have been determined.

### 3. Comparison of Location and Transportation Criteria's in BREEAM And LEED Healthcare

Purpose of this section according to BREEAM and LEED certification system in healthcare corresponding subheadings to each other are compared. Table.1 has been constituted for this purpose. Afterward conditions to be provided under the headings have been examined in detail.

**Table 1.** Comparison for LEED and BREEAM about location and Transportation

<b>LEED</b>	<b>BREEAM</b>
location and transportation	Transport
Access to quality transit	Public transport accessibility
Reduced parking footprint	Maximum car parking capacity
LEED for neighborhood development location	--
Sensitive land protection	--
High-priority site	--
Surrounding density and diverse uses	--
Bicycle facilities	--
Green vehicles	
--	Proximity to amenities
--	Alternative modes of transport
--	Travel plan

#### 3.1. LEED location and transportation

##### 3.1.1. Access to quality transit (1–2 points)

Locate any functional entry of the project within a ¼-mile walking distance of existing or planned bus, streetcar, or rideshare stops, or within a ½-mile walking distance of existing or planned bus rapid transit stops, light or heavy rail stations, commuter rail stations or commuter ferry terminals. The transit service at those stops and stations in aggregate must meet the minimums listed in Tables. Planned stops and stations may count if they are sited, funded, and under construction by the date of the certificate of occupancy and are complete within 24 months of that date.

Projects served by two or more transit routes such that no one route provides more than 60% of the prescribed levels may earn one additional point, up to the maximum number of points.

If existing transit service is temporarily rerouted outside the required distances for less than two years, the project may meet the requirements, provided the local transit agency has committed to restoring the routes with service at the prior level.[3]

##### 3.1.2. Reduced parking footprint (1 point)

Do not exceed the minimum local code requirements for parking capacity. Provide parking capacity that is a percentage reduction ratios recommended by the Parking Consultants Council, as shown in the Institute of Transportation Engineers' Transportation Planning Handbook.

Case 1. Baseline Location. Projects that have not earned points under Surrounding Density and Diverse Uses or Access to Quality Transit must achieve a 20% reduction from the base ratios.

Case 2. Dense and/or Transit-Served Location. Projects earning 1 or more points under either Surrounding Density and Diverse Uses or Access to Quality Transit must achieve a 40% reduction from the base ratios.[3]

### **3.1.3. LEED for neighbourhood development location (5–9 points)**

Locate the project within the boundary of a development certified under LEED for Neighbourhood Development.

### **3.1.4. Sensitive land protection (1 point)**

Option 1. Locate the development footprint on land that has been previously developed. OR

Option 2. Locate the development footprint on land that has been previously developed or that does not meet the following criteria for sensitive land:

- Prime farmland. Prime farmland, unique farmland, or farmland of state-wide or local importance as defined by the U.S. Code of Federal Regulations, (or local equivalent for projects outside the U.S.) and identified in a state Natural Resources Conservation Service soil survey (or local equivalent for projects outside the U.S.).
- Floodplains. A flood hazard area shown on a legally adopted flood hazard map or otherwise legally designated by the local jurisdiction or the state. For projects in places without legally adopted flood hazard maps or legal designations, locate on a site that is entirely outside any floodplain subject to a 1% or greater chance of flooding in any given year.
- Habitat. Land identified as habitat for the following:
- Water bodies. Areas on or within 100 feet of a water body, except for minor improvements.
- Wetlands. Areas on or within 50 feet of a wetland, except for minor improvements.

Minor improvements within the wetland and water body buffers may be undertaken to enhance appreciation of them, provided such facilities are open all building users. Only the following improvements are considered minor:

- Bicycle and pedestrian pathways no more than 12 feet wide, of which no more than 8 feet may be impervious;
- Activities to maintain or restore native natural communities and/or natural hydrology;
- One single-story structure per 300 linear feet on average, not exceeding 500 square feet;
- Grade changes necessary to ensure public access;
- Clearings, limited to one per 300 linear feet on average, not exceeding 500 square feet each;
- Removal of the following tree types:

The condition rating must be based on an assessment by an arborist certified by the International Society of Arboriculture (ISA) using ISA standard measures, or local equivalent for projects outside the U.S.

- Brownfield remediation activities.

### **3.1.5. High-priority site (1-2 points)**

The following is required to demonstrate compliance:

Option 1. Historic District

Locate the project on an infill location in a historic district. OR

Option 2. Priority Designation

Locate the project on one of the following:

a site listed by the EPA National Priorities List, a Federal Empowerment Zone site, a Federal Enterprise Community site, a Federal Renewal Community site, a Department of the Treasury Community Development Financial Institutions Fund Qualified Low- Income Community (a subset of the New Markets Tax Credit Program), a site in a U.S. Department of Housing and Urban Development's Qualified Census Tract (QCT) or Difficult Development Area (DDA); or

- a local equivalent program administered at the national level for projects outside the U.S. OR

Option 3. Brownfield Remediation. Locate on a brownfield where soil or groundwater contamination has been identified, and where the local, state, or national authority (whichever has jurisdiction) requires its remediation. Perform remediation to the satisfaction of that authority.[4][5]

### **3.1.6. Surrounding density and diverse uses (1 points)**

Option 1. Surrounding Density. Locate on a site whose surrounding existing density within a ¼- mile radius of the project boundary is:

1. At least 7 dwelling units per acre with a 0.5 floor-area ratio. The counted density must be existing density, not zoned density, or
2. At least 22,000 square feet per acre of buildable land.

Option 2. Diverse Uses .Construct or renovate a building on a site such that the building's main entrance is within a ½-mile (800- meter) walking distance of the main entrance of at least seven operational and publicly accessible uses.

### **3.1.7. Bicycle facilities (1 point)**

Design or locate the project such that a functional entry and/or bicycle storage is within a 200-yard (180-meter) walking distance or bicycling distance of a bicycle network that connects to at least one of the following:

- at least 10 diverse uses; or
- a bus rapid transit stop, light or heavy rail station, commuter rail station, or ferry terminal.

All destinations must be within a 3-mile bicycling distance of the project boundary.

Planned bicycle trails or lanes may be counted if they are fully funded by the date of the certificate of occupancy and are scheduled for completion within one year of that date.

Bicycle Storage and Shower Rooms. Case 1. Commercial or Institutional Projects

Provide short-term bicycle storage for at least 2.5% of all peak visitors, but no fewer than four storage spaces per building.

Provide long-term bicycle storage for at least 5% of regular building occupants (excluding patients), but no fewer than four storage spaces per building in addition to the short-term bicycle storage spaces.

Provide at least one on-site shower with changing facility for the first 100 regular building occupants (excluding patients) and one additional shower for every 150 regular building occupants thereafter.[3]

### **3.1.8. Green vehicles (1 point)**

Designate 5% of all parking spaces used by the project as preferred parking for green vehicles. Clearly identify and enforce for sole use by green vehicles. Distribute preferred parking spaces proportionally among various parking sections (e.g. between short-term and long-term spaces).

Green vehicles must achieve a minimum green score of 45 on the American Council for an Energy Efficient Economy (ACEEE) annual vehicle rating guide (or local equivalent for projects outside the U.S.).

A discounted parking rate of at least 20% for green vehicles is an acceptable substitute for preferred parking spaces. The discounted rate must be publicly posted at the entrance of the parking area and permanently available to every qualifying vehicle.

In addition to preferred parking for green vehicles, meet one of the following two options for alternative fuel stations:

Option 1. Electric Vehicle Charging. Install electrical vehicle supply equipment (EVSE) in 2% of all parking spaces used by the project. Clearly identify and reserve these spaces for the sole use by plug-in electric vehicles. EVSE parking spaces must be provided in addition to preferred parking spaces for green vehicles. OR

Option 2. Liquid, gas, or battery facilities.

Install liquid or gas alternative fuel facilities or a battery switching station capable of refuelling a number of vehicles per day equal to at least 2% of all parking spaces.[6]

### **3.2. BREEAM Transport**

#### **3.2.1. Public transport accessibility (5 points)**

1. The public transport Accessibility Index (AI) for the assessed building is calculated and BREEAM credits awarded in accordance with the building types, AI benchmarks and BREEAM credits in Table (Credits available for each building type relating to the public transport Accessibility Index (AI) score).

2. The Accessibility Index is determined by entering the following information in to the BREEAM Tra 01 calculator:

2.a The distance (m) from the main building entrance to each compliant public transport node

2.b The public transport types serving the compliant node, e.g. bus or rail

2.c The average number of services stopping per hour at each compliant node during the operating hours of the building for a typical day (see compliance notes and Table (Default hours of operation by building type for a typical day) OR

Dedicated bus service

3. For buildings with a fixed shift pattern, i.e. where building users will predominantly arrive or depart at set times, one credit can be awarded where the building occupier provides, or commits to providing a dedicated bus service to and from the building at the beginning and end of each shift or day.

This credit is only available in cases where a development is unable to achieve any of the available credits using the Accessibility Index criteria (i.e. its location has a low public transport Accessibility Index).

#### **3.2.2. Maximum car parking capacity (2 points)**

1. The building's car parking capacity is compared to the maximum car parking capacity benchmarks in Table and the relevant number of credits awarded.

For most building types, except those where stated, the benchmarks vary according to the building's public transport Accessibility Index. Therefore, for these building types the AI must be determined prior to assessing this issue. This is required to ensure that the building's car parking capacity is relative to the development's accessibility to the public transport network.

#### **3.2.3. Proximity to amenities (2 points)**

1. All building types, except Type 6, must be located within the stated proximity of at least two accessible core amenities. The remaining number of amenities required, in Table, must be met using any other applicable amenities (including any remaining core amenities).

**3.2.4. Alternative modes of transport (2 points)**

## Option 1

1. During the preparation of the brief the design team has consulted with the local authority on the state of the local cycling network and how the development could contribute to improving it.

2. One proposition has been chosen in agreement with the local authority and implemented. This proposition must be additional to what would have been done by the local authority without the support from the project and must have a significant impact on the local cycling network.

## Option 2

3. Negotiations with local bus companies have resulted in an increase of the local service provision in the development's local area.

4. This increase in public transport service has improved the existing AI by at least 1.00.

## Option 3

5. Electric recharging stations have been provided for at least 3% of the total car parking capacity for the building.

6. The design team can demonstrate electric vehicles using these charging points will have lower CO<sub>2</sub> emissions than their petrol or diesel counterparts.

## Option 4

7. A car sharing group or facility has been set up to facilitate and encourage building users to sign up to a car sharing scheme.

8. Marketing material has been developed to help raise awareness of the system and will be communicated to the tenants where applicable.

9. Priority spaces for car sharers are provided for at least 5% of the total car parking capacity for the building.

10. Priority spaces are located in the nearest available spaces in the nearest available parking area to the main building entrance on site.

## Option 5

11. Compliant cycle storage spaces that meet the minimum levels set out in Table are installed.

**3.2.5. Travel plan (1 points)**

1. A travel plan has been developed as part of the feasibility and design stages.

2 .A site-specific travel assessment or statement has been undertaken to ensure the travel plan is structured to meet the needs of the particular site and covers the following (as a minimum):

2.a Where relevant, existing travel patterns and opinions of existing building or site users towards cycling and walking so that constraints and opportunities can be identified

2.b Travel patterns and transport impact of future building users

2.c Current local environment for walkers and cyclists

2.d Disabled access

2.e Public transport links serving the site

2.f Current facilities for cyclists.

3 .The travel plan includes a package of measures to encourage the use of sustainable modes of transport and movement of people and goods during the building's operation and use.

4 .If the occupier is known, they must be involved in the development of the travel plan and they must confirm that the travel plan will be implemented post-construction and be supported by the building's management in operation.[7]

#### 4. Results

When we study LEED and BREEAM certifications health care and hospital related items, BREEAM consists of 10 main criteria and the buildings examine some of the main criteria and indicate to which building the specific criteria are included.

Some criteria apply to all buildings. The departments related to the hospitals are included in the sub-headings and include them in the non-standard building group. In the LEED certification system, there are 8 main headings and the hospitals are separated as a separate topic title. This section of the assessment criteria are specified or score calculation are required. LEED and BREEAM certification systems have point changes for the same criteria. This means that different weights are given to the same criteria. In addition, some criteria are not found in the other certification system.

LEED subheadings require a selection and support by giving a table and figure and referring to the calculation method. On the other hand, BREEAM suggests the purpose of subheadings is to make detailed calculations. In some titles, only certain group buildings are covered. For example, some sub-headings cover all buildings, some headings only make a difference, including schools or non-residential buildings.

the LEED and BREEAM certificate ratings are different in the systems. LEED has been evaluated over 110 and four different certificates have been awarded while the BREEAM evaluation system has evaluated over 85 points and has six different certificate types. there are 8 sub-headings under location and transportation in the LEED certification system. total LEED score is 18 . When we compare LEED and BREEAM certification systems about location and transportation in healthcare building similarity and differential are by the following.

In terms of similarity in BREEAM and LEED certificate system in the parking issue in LEED is the reduced parking footprint. Aim, to minimize the environmental harms associated with parking facilities, including automobile dependence, land consumption, and rainwater runoff. Also Provide parking capacity that is a percentage reduction ratios recommended by the Parking Consultants Council, as shown in the Institute of Transportation Engineers. also in BREEAM certificate system is the maximum car parking capacity. Aim, to encourage the use of alternative means of transport other than the private car to and from the building, thereby helping to reduce transport-related emissions and traffic congestion

associated with the building's operation. Table of Building's Accessibility Index depended on building type and Max. parking capacity1 space per x building users, where x is certain, Credits is available. Also other criteria in LEED and BREEAM certificate system in healthcare building transportation are different.

When we compare the LEED and BREEAM certificate system in transportation in healthcare building in terms of similarity in the accessibility issue in LEED certificate system is the access to quality transit. Aim, to encourage development in locations shown to have multimodal transportation choices or otherwise reduced motor vehicle use, thereby reducing greenhouse gas emissions, air pollution, and other environmental and public health harms associated with motor vehicle use. The Minimum daily transit service for projects with multiple transit types table given Points depended on Weekday and Weekend trips. Also in BREEAM certificate system is the public transport accessibility. Aim, to recognize and encourage development in proximity of good public transport networks, thereby helping to reduce transport-related pollution and congestion. BREEAM credits is available according to Accessibility Index Depending on Building type that relating to the public transport score table. Operation for a typical day table Depending on Building type that Default hours is given.

LEED for neighbourhood development location. Aim, to avoid development on inappropriate sites. to reduce vehicle distance traveled. to enhance livability and improve human health by encouraging daily physical activity. The points for LEED neighborhood development location table depended on certification level is given. also the project must locate within the boundary of a development certified under LEED for neighbourhood development. This credit is not available at BREEAM.

LEED - Sensitive land protection. Aim, to avoid the development of environmentally sensitive lands and reduce the environmental impact from the location of a building on a site. Relevant to the Prime farmland use as defined by the U.S. Code of Federal Regulations, (or local equivalent for projects outside the U.S.) and identified in a state Natural Resources Conservation Service soil survey (or local equivalent for projects outside the U.S.). Also about Habitat species listed as threatened or endangered under the U.S. Endangered Species Act or the state's endangered species act, or species or ecological communities classified by Nature Serve. This credit is not available at BREEAM.

LEED - High-priority site. Aim, to encourage project location in areas with development constraints and promote the health of the surrounding area. there are 3 options historic district, brownfield remediation and priority designation also these include a department of the treasury community development financial institutions fund qualified low- income community and a site in a u.s. department of housing and urban development's qualified census tract (qct) or difficult development area (dda). Also it must be a site listed by the epa national priorities list. This credit is not available at BREEAM.

LEED - Surrounding density and diverse uses. Aim, to conserve land and protect farmland and wildlife habitat by encouraging development in areas with existing infrastructure. To promote walkability, and transportation efficiency and reduce vehicle distance traveled. To improve public health by encouraging daily physical activity. Relevant this issue there are 2 Option Surrounding Density and Diverse Uses that is defined by numbers and distances. This credit is not available at BREEAM.

LEED - bicycle facilities. Aim, to promote bicycling and transportation efficiency and reduce vehicle distance traveled. To improve public health by encouraging utilitarian and recreational physical activity. Relevant this issue there are Bicycle Storage and Shower Rooms that Provide bicycle storage and shower facilities. Also about Bicycle Network there is all destinations must be within certain distance of the project boundary. This credit is not available at BREEAM.



LEED - green vehicles. Aim, to reduce pollution by promoting alternatives to conventionally fueled automobiles. there are two options include electric vehicle charging and liquid, gas, or battery facilities also these include green vehicles must achieve a minimum green score on the American council for an energy efficient economy (aceee) annual vehicle rating guide (or local equivalent for projects outside the u.s.). Also comply with the relevant regional or local standard for electrical connectors, such as sae surface vehicle recommended practice j1772, sae electric vehicle conductive charge coupler or iec 62196 of the international electro technical commission for projects outside the u.s. This credit is not available at BREEAM.

There are five subheadings under the heading transportation in the BREEAM certification system. Total BREEAM score is 12 proximities to amenities. Aim, to encourage and reward a building location that facilitates easy access to local services and so reduces the environmental, social and economic impacts resulting from multiple or extended building user journeys, including transport-related emissions and traffic congestion. Table Depending on Building type number of BREEAM credits, number of amenities required, Proximity (metres), Appropriate food outlet , Access to cash, Access to a recreation or leisure facility for fitness or sports, Access to an outdoor open space (public or private, suitably sized and accessible to building users), Publicly available postal facility, Community facility, Over the counter services associated with a pharmacy, Public sector doctor's surgery or general medical centre, Child care facility or school Criteria is available. This credit is not available at LEED.

BREEAM - Alternative modes of transport. Aim, to provide facilities which encourage building users to travel using low carbon modes of transport and to minimize individual journeys. In the Cycle storage criteria table Depending on Building type is given such as No. spaces per unit of measure, Unit of measure, Notes. This credit is not available at LEED.

BREEAM -Travel plan. Aim, to recognize the consideration given to accommodating a range of travel options for building users, thereby encouraging the reduction of reliance on forms of travel that have the highest environmental impact. This credit is not available at LEED.

In the BREEAM certification system, it has been determined that either the general expression limit values or the use of certain computer programs or table values, the calculation methods are used in order to meet the criteria mentioned in the location and transportation in both systems. The LEED certification system is also supported by tables such as points for LEED neighborhood development location, cycle storage criteria for each building type, minimum daily transit service for projects with multiple transit types, minimum daily transit service for projects with commuter rail or ferry service only.

In the LEED certification system options such as historic district, priority designation, brownfield remediation, surrounding density, diverse uses, bicycle network, bicycle storage and shower rooms, commercial or institutional projects, baseline location, dense and/or transit-served location, electric vehicle charging, liquid, gas, or battery facilities are given. In the BREEAM certificate are supported with tables such as default hours of operation by building type for a typical day, credits available for each building type relating to the public transport accessibility index (ai) score, credits available in maximum car parking capacity for different building types and credits available for tra 02 for different building types. It is also supported by different options such as car parking capacity, dedicated bus service, accessibility index.

## References

[1] BREEAM International New Construction 2016 , <http://www.breem.com/> England

- [2] LEED v4 for Building Design And Construction 2017, <https://www.usgbc.org/> USA
- [3] Alternative Transportation Commuting Resource Information, Transportation Demand Management Institute, USA,2009.
- [4] U.S. Department of Housing and Urban Development, Qualified Census Tracts and Difficult Development Areas Standards, USA, 2017.
- [5] U.S. Environmental Protection Agency, National Priority List Standards, 2017.
- [6] Instituto Nacional de Metrologia, Qualidade e Tecnologia (INMETRO) Standards, Brazil,2017.
- [7] <https://www.gov.uk/government/publications/guidance-on-transport-assessment>, 2017