

LEED Certification Performance Review and Post Occupancy Study of Health Care Facilities

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Executive Summary

In summer 2017, I worked at the Lower Mainland Facilities Management (LMFM) as a sustainability scholar. LMFM is a department within the Lower Mainland Consolidation (LMC) that manages the facilities of the four health organizations in the Lower Mainland. These four health organizations are: Fraser Health Authority (FHA), Providence Health Care (PHC), Provincial Health Services Authority (PHSA), and Vancouver Coastal Health (VCH). My work at LMFM entailed three main parts:

- 1) Reviewing LEED Certification performance for healthcare facilities
- 2) Identifying the connections between the Healthy Built Environment (HBE) Toolkit and the LEED V4 for Building Design and Construction (BD+C)
- 3) Developing a protocol (consisting of a combination of template and process) for Post Occupancy Evaluation of healthcare facilities in the Lower Mainland

The scope and results of my work in each of these three are briefly described in the following sections:

1. LEED Certification Performance Review

In order to provide more environmentally sustainable healthcare delivery, and in keeping with the Provincial mandate¹, the Lower Mainland health authorities have been designing new facilities to meet LEED (Leadership in Energy and Environmental Design) standards. Different levels of LEED Certification (Certified to Gold) have been achieved by these facilities.

¹ In accordance with the 2008 BC Climate Action Plan and its policy mandate requiring “all new public buildings to be built to LEED Gold Standards”. Please see page 22, “A Carbon-Neutral Public Sector” section of the BC Climate Action Plan (http://www.gov.bc.ca/premier/attachments/climate_action_plan.pdf)

In 2014 and 2016, the Energy and Environmental Sustainability (EES) team at LMFM reviewed a total of nine LEED Certified facilities to identify the areas of challenge, success, and lessons learned from these projects. These two previous studies go into significant project-specific detail. As a sustainability scholar, I synthesized the key information from the previous reports into a single document summarizing concisely the areas of challenge, success, and lessons learned from these projects in a way that is easily digestible and can inform future projects.

While the challenges experienced were often unique for each site, the analyses identified common themes across the buildings. The following main categories and sub-categories were created to represent these common themes (Table1).

Table 1: Key areas of challenge

Main Categories of challenge	Sub-categories of challenge
Site and building architecture	Parking spaces, biking facilities, access and security, materials, interior layout and furniture
Heating, cooling, and ventilation systems	System capacity, system efficiency, system operation and maintenance, system quality
Water systems	Irrigation system, toilet flushing, rainwater collection system
Indoor environmental quality	Lighting, acoustics, thermal comfort
Knowledge and skills	Building design, building operation and maintenance, building use

These categories were used to organize the challenges and summarize the extent to which each challenge was experienced. A similar approach was taken to identify the common themes in areas of success reported across the health care facilities. It is worth noting that some of these challenges may also be experienced by projects that have not pursued LEED Certification.

A number of lessons can be learned from the challenges experienced in the healthcare facilities reviewed in this study, and these suggest possible ways to improve LMFM’s approach moving forward. Viewing the identified challenges through a lens of building lifecycle stages, they can be linked to a specific stage of the building lifecycle. This is useful since efforts to improve the process can be focused on the relevant building lifecycle stage. A series of recommended improvements and lessons learned were developed for each of the following four categories and reported to LMFM: 1) planning and design, 2) construction, 3) commissioning, 4) operation and use

2. The Connections between the Healthy Built Environment (HBE) Toolkit and LEED V.4 (BD+C)

The Healthy Built Environment (HBE) toolkit is a project of the Provincial Health Services Authority (PHSA) Population and Public Health team under the leadership of the Healthy Built Environment Alliance (HBEA). This toolkit focuses on five physical features of a healthy built environment and identifies 21 planning principles to achieve them. These five physical features include:

- Healthy neighbourhood design
- Healthy transportation networks
- Healthy natural environments
- Healthy food systems
- Healthy housing

As part of my work at LMFM, I conducted a content analysis of this toolkit and its planning principles as well as the Reference Guide for LEED V4 Building Design and Construction (BD+C) to identify whether there exist any connections between HBE and LEED. My study indicates that several LEED credits and prerequisites are supported by HBE planning principles and vice versa. The LEED credit categories that were found to be correlated to each of the five physical features of the HBE toolkit are indicated in Table 2.

Table 2: Connections between HBE and LEED

HBE Physical Features		LEED Credit Categories
Healthy Neighbourhood Design	↔	LEED Location and Transportation Sustainable Sites
Healthy Transportation Networks	↔	LEED Location and Transportation Sustainable Sites
Healthy Natural Environments	↔	LEED Location and Transportation Sustainable Sites Energy and Atmosphere
Healthy Food Systems	↔	Sustainable Sites
Healthy Housing	↔	Sustainable Sites Energy and Atmosphere Materials and Resources Indoor Environmental Quality

In my project report to LMFM, I specified in detail which LEED credits and prerequisites correspond to each of the five features of a healthy built environment and their relevant planning principles. This resource can serve as a conversation-starter between various practitioners and stakeholders involved in the design of healthcare facilities and communities in the Lower Mainland, and help decision makers to better understand the health-related outcomes of the LEED credits they aim for in each project.

3. Post Occupancy Evaluation of Health Care Facilities

The aim of this project was to develop a protocol (consisting of a combination of template and process) for Post Occupancy Evaluation (POE) of healthcare facilities in the Lower Mainland. As a sustainability scholar, my role was to design and conduct the first of multiple phases of this project. This involved the following:

- Identifying the key steps for conducting POE and the actions required to be taken at each step
- Reviewing the existing POE tools and protocols and identify the evaluation focus areas that can be considered for the LMFM's POE protocol
- Designing a decision-making process based on Multi-Criteria Decision Making (MCDM) methods to implement for engaging with the stakeholders involved in the development of the POE protocol
- Testing the designed process for a selected facility. This included:
 - Reviewing project documents and information
 - Engaging with various actors involved in the procurement, design, construction, and operation of the selected facility and conducting interviews with them
 - Organizing and facilitating a group decision making exercise with the key stakeholders of the selected facility
 - Analysing the results of the interviews and decision making exercise and identifying the focus areas for the post occupancy evaluation of the selected facility and specifying the next steps
- Preparing a detailed report documenting the project's approach, results, and next steps

Post occupancy evaluation of a healthcare facility can focus on a subset or all of the following areas:

- a) Building systems and physical environment
 - interior elements and space configuration
 - building envelope
 - environmental impacts
 - indoor environmental quality
- b) Occupants experience and perception
 - personal control and comfort
 - design features and space configuration
 - perception of environmental impacts
 - perception of health and productivity
 - indoor environmental comfort
- c) Effectiveness and efficiency of care

A POE can take various forms depending on the goals of the organization conducting the POE, specifics of each facility, and the available resources. The results of my work in completing the first phase of this project provide the foundations of a process which enables comprehensive and multi-faceted evaluation of health care facilities of Lower Mainland post occupancy. The next phases of this project entail further refinement of the POE protocol using the pilot testing results; investigating strategies for closing the feedback- loop between different phases of a building project (i.e. planning and design, construction, commissioning, and operation and use); and exploring opportunities to link business drivers with post occupancy performance evaluation in different types of facilities within the healthcare authorities in Lower Mainland.